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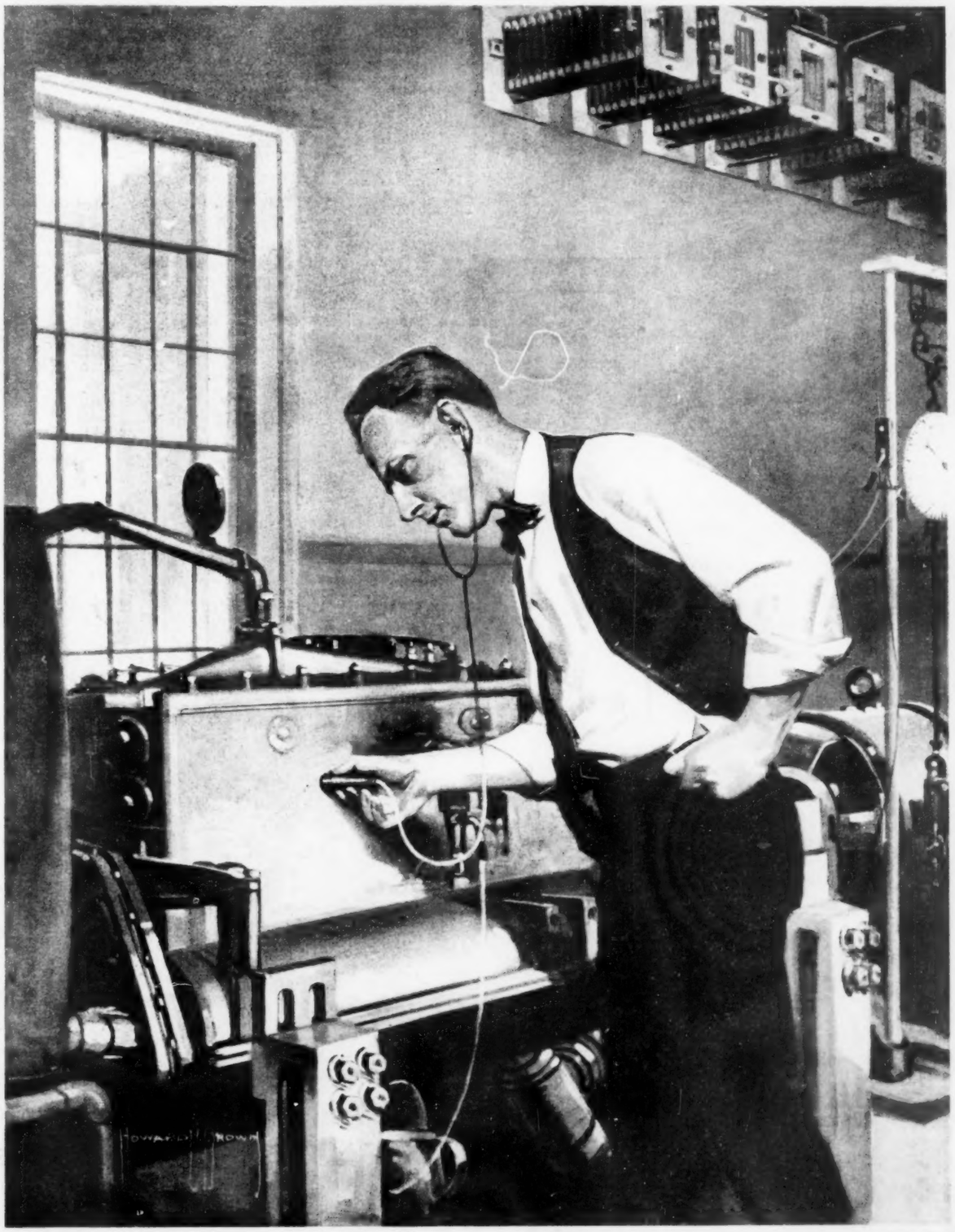
MAKING THE BARGE CANAL PAY
ONE HUNDRED YEARS OF GAS LIGHTING

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



DETECTING AND LOCATING AUTOMOBILE ENGINE TROUBLES WITH THE STETHOSCOPE.—[See page 545]

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from GUESSWORK to a SCIENCE

How the Chart established America's Supremacy in Scientific Automobile Lubrication

"EVERY great scientific truth," said Agassiz, "goes through three stages. First, people say it conflicts with the Bible. Next, they say it has been discovered before. Lastly, they say they have always believed it."

You may not realize that scientific automobile lubrication has passed through three somewhat similar stages—indifference—passive acceptance—active endorsement.

Fifteen years ago the Vacuum Oil Company organized its study of motor car lubrication. We were the first to take up in a scientific manner the lubricating problems of all makes of motor cars.

As a result of careful analysis and experiment there was formulated the first Chart of Recommendations ever made for automobile engine lubrication. Although there were then only about 125,000 motor cars on the roads, the Vacuum Oil Company foresaw the immense possibilities of the automobile. They felt keenly that more might be properly demanded of an oil than "that it kept the car running all right."

By the fall of 1906, the first Chart was complete. In January, 1907,the Chart was ready—in booklet form—for general distribution.

The Chart in two respects was revolutionary. It specified different grades of oil for different cars. In some cases it specified a different grade of oil for winter use than that recommended for summer.

In its early history the Vacuum Oil Company Chart of Automobile Recommendations did not escape belittlement. But by the sheer soundness of the scientific principles advanced, and by the sheer quality of the grades of Gargoyle Mobiloils provided, the outcome was never uncertain.

Chart of Recommendations
for AUTOMOBILES
(Abbreviated Edition)

How to Read the Chart

THE Correct Grades of Gargoyle Mobiloils for engine lubrication are specified in the Chart below.

A means Gargoyle Mobiloil "A"
B means Gargoyle Mobiloil "B"
E means Gargoyle Mobiloil "E"
Arc means Gargoyle Mobiloil Arctic

These recommendations cover all models of both passenger and commercial vehicles unless otherwise specified.

NAMES OF AUTOMOBILES AND MOTOR TRUCKS	1920		1919		1918		1917		1915	
	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter
Allen	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Apperson	A	Arc	A	Arc	A	Arc	A	Arc		
Briscoe	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Biddle	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Buick	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cadillac	A	A	A	A	A	A	A	A	A	A
Chalmers (6-40)									Arc	Arc
" (6-45)									A	Arc
" All Other Models	A	A	A	A	A	A	A	A	A	A
Chandler 6-66	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Chevrolet (4 cylinder)			A	A	A	A	A	A		
" (FA)			A	Arc	A	Arc				
" (H & I ton)	A	Arc								
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Cleveland	A	Arc								
Cunningham	A	A	A	A	A	A	A	A	A	A
Dixie Flyer	A	Arc	A	Arc	A	Arc	A	Arc		
Dodge Brothers	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Ford										
Federal (Model 5-K)					A	A	A	A		
" (Special)					Arc	Arc				
" All Other Models	Arc	Arc	Arc	Arc	A	A	Arc	Arc	Arc	Arc
Ford	E	E	E	E	E	E	E	E	E	E
Fageol	A	A	A	A	A	A	A	A	A	A
G. M. C. Trucks	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Gleason (4 cylinder)	A	Arc			A	Arc	A	Arc	A	Arc
" (Com.) (Model 12)			A	Arc						
" All Other Models	Arc	Arc	Arc	Arc						
Haynes (6 cylinder)	A	A	A	A	A	Arc	A	Arc	A	Arc
" (12 cylinder)	A	A	A	A	A	A	A	A	A	A
Holmes	B	A								
Hudson Super Six	A	Arc	A	Arc	A	Arc	A	Arc	A	A
" All Other Models									Arc	Arc
Hupmobile	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Lewis	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
Locomobile	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc		
Lozier	A	A	A	A	A	A	A	A	A	A
King (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Kissel Kar (Model 6B)									A	A
" (12 cylinder)					A	A				
" All Other Models	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Liberty	A	A	Arc	Arc	Arc	Arc	Arc	Arc		
Locomobile	A	E	A	E	A	E	E	E	E	E
Lexington			Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
Marmon (Fr. type)	A	A	A	A	A	A	A	A		
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Maxwell	A	A	A	A	A	A	A	A	A	A
Marion	A	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Mercer	A	A	A	A	A	A	A	A	A	A
Mitchell (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" (8 cylinder)									A	A
Moline-Knight			B	A	B	A	A	A	A	A
Monroe Model 51									E	E
" M.S.					A	Arc	A	Arc		
" All Other Models	A	A	A	A	A	A	A	A		
Nash (Quad)	A	A	A	A	A	A				
" (Model 671)					A	A				
" All Other Models	A	Arc	A	Arc	A	Arc				
Needham (6 cylinder)	A	A	Arc	Arc	Arc	Arc	Arc	Arc	A	Arc
" (12 cylinder)			A	A	A	A	A	A	A	A
Nelson	A	A	A	A	A	A	A	A		
Noble	A	A	Arc	Arc	Arc	Arc	Arc	Arc		
Oakland (8 cylinder)									A	A
" All Other Models	A	A	A	A	A	A	Arc	Arc	Arc	Arc
Old Hickory	Arc	Arc	Arc	Arc	A	A	Arc	Arc	A	Arc
Oldsmobile (4 cylinder)	A	A	A	A					Arc	Arc
" (6 cylinder)	A	A	A	A	A	A	Arc	Arc		
" (8 cylinder)	A	A	A	A	A	A	A	A	A	A
Oshkosh	A	Arc	A	Arc						
Overland	A	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Packard	A	A	A	A	A	A	A	A	A	A
Paige (6 cylinder)	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
" Com. Veh.	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" All Other Models	A	A								
Pan (Model A)	A	Arc	A	Arc	A	Arc				
" (Model 2M)					Arc	Arc				
Peerless (6 cylinder)	A	A	A	A	A	A	A	A	A	A
" All Other Models					Arc	Arc	Arc	Arc	Arc	Arc
Pierce Arrow	A	A	A	A	A	A	A	A	A	A
" (Com.) (1 ton)	A	A	A	A	Arc	Arc	Arc	Arc	Arc	Arc
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Premier	A	A	A	A	A	A	A	A	A	Arc
R & V Knight	B	A								
Reo	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Riker	A	E	A	E	A	E	E	E		
Rock Falls	A	Arc	A	Arc						
Sanford	Arc	Arc	Arc	Arc	A	A	A	Arc	A	Arc
Saxon			E	E	E	E	E	E	E	E
Scripps-Booth (4 cylinder)					A	A	A	Arc	A	Arc
" (6 & 8 cylinder)	A	A	A	A	A	A	A	A	A	A
Stearns-Knight	B	A	B	A	A	A	B	A	A	A
Studebaker	A	Arc	A	Arc	A	Arc	A	Arc	A	Arc
Stutz	A	A	A	A	A	A	A	A	A	A
Templar	A	A	A	A	A	A				
United (Grand Rapids) (2½ ton)	A	A	A	A					Arc	Arc
" " " (3½ ton)	A	A	A	A	A	A	Arc	Arc	Arc	Arc
" " " (5 ton)			A	A			A	A		
" " " (7 ton)	A	A	A	A	A	A	A	A	A	A
" " " (10 ton)			A	A						
" All Other Models	A	A	A	Arc	A	Arc	Arc	Arc	Arc	Arc
Velie (Model 34)	A	Arc								
" (6 cylinder)	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
" (Com.) (1½ ton)			A	Arc	A	Arc				
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc				
Vim (Models 22, 23 and 24)	A	A	A	A						
" (Model 25)	A	A	Arc	Arc						
" All Other Models	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Westcott	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
White (6 valve)			A	A	A	A	A	A		
" (3 ton)			A	A	Arc	Arc				
" All Other Models			Arc	Arc	Arc	Arc	Arc	Arc	Arc	Arc
Willys-Knight	B	A	B	A	B	A	A	A	B	A
Willys 6cc	A	Arc	Arc	Arc						
Winther 6cc	A	Arc								
" (Com.)	A	A	A	A						
Winther-Marwin (1½ ton)	A	A	Arc	Arc						
" All Other Models	A	Arc	A	A						
Winton	Arc	Arc	Arc	Arc	Arc	A				

The Chart first appeared when touring cars were advertised as "double phaetons"—when the fashionable automobile was characterized by red paint and a great deal of exterior brasswork.

Today no one longer questions the soundness of the advice given through the Vacuum Oil Company's Chart of Recommendations. This Chart points the way to scientific automobile lubrication the world over. Over a million copies have been distributed in the United States during 1920. Hundreds of thousands of copies are in active use in all parts of the globe.

The Chart, and the several grades of Gargoyle Mobiloils have thus established America's supremacy in the field of scientific automobile lubrication.

To follow the Chart is to admit that science and experience count in automobile lubrication as well as in other fields of endeavor.

If the partial Chart shown here does not list your car, send for a copy of our book "Correct Automobile Lubrication," which contains the complete Chart. Or consult the complete Chart at your dealer's.

GARGOYLE

Mobiloils

A grade for each type of motor

VACUUM OIL COMPANY — *Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.* — NEW YORK, U.S.A.

Domestic Branches: New York, Boston, Philadelphia, Pittsburgh, Detroit, Chicago, Minneapolis, Indianapolis, Kansas City, Kan., Des Moines

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SEVENTY-SIXTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

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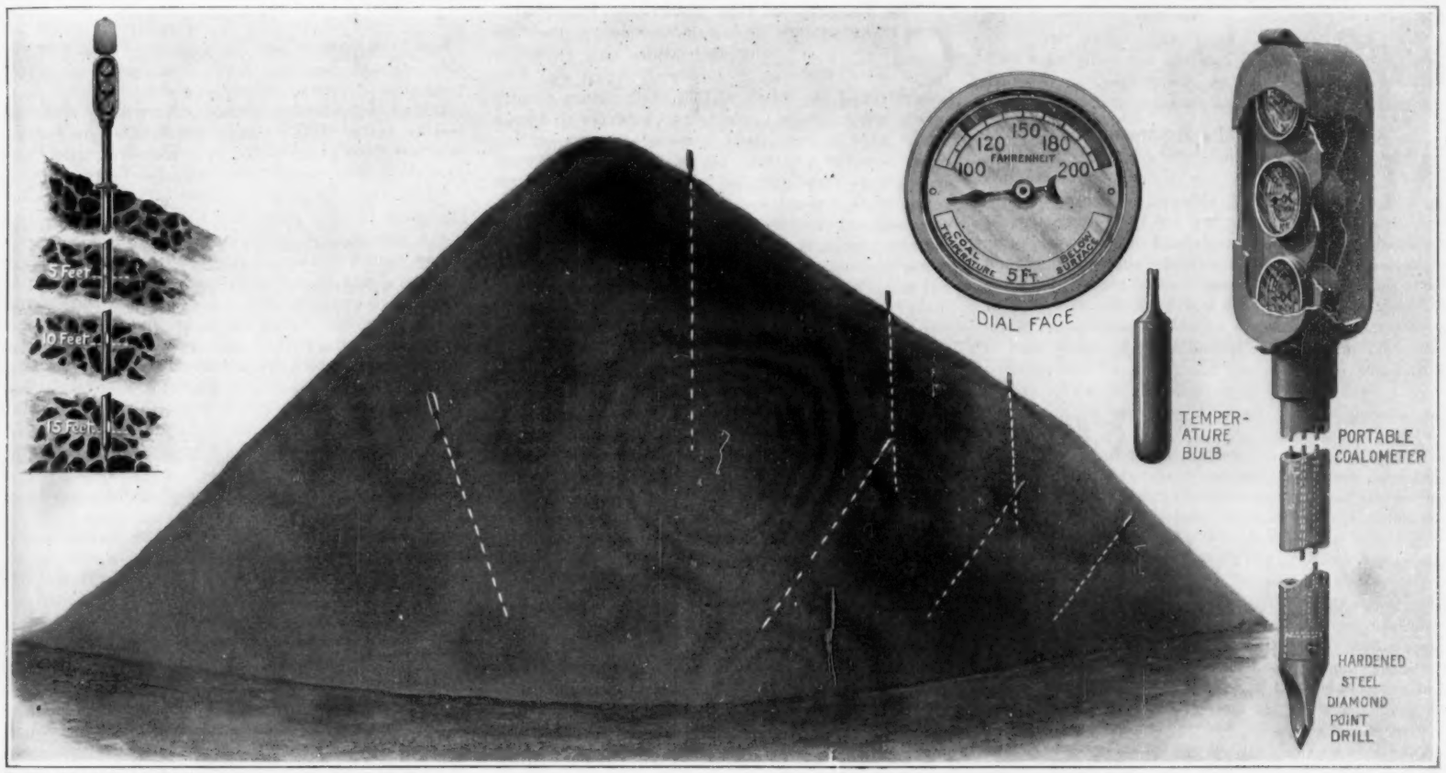

Details of the coalometer, which detects heat losses in the soft-coal pile, and how it is installed to keep tabs on different sections and different depths of a pile

Detecting and Preventing Leakage in the Soft-Coal Pile

By R. P. Nichols

A NEW device for indicating the thermal conditions of stored soft coal will be of interest to those who use bituminous fuel in quantity. For it is a fact that coal deteriorates under certain conditions. Quoting from Porter on "Weathering of Coals," 1915:

"Porter and Brunton also found that a coal pile may be covered with snow, yet 3 feet below the surface of the coal the temperature may be quite high."

The new device, known as the coalometer, was designed for either permanent or removable installations, to meet the conditions encountered whenever soft coal is allowed to lie in storage for an appreciable time, awaiting removal. The instrument in its perfected state was developed from a joint invention of Prof. A. W. Browne, Professor of Chemistry at Cornell University, one of America's leading scientists, and the writer.

As is well known, bituminous coal has the property of spontaneously heating, in certain spots, and at varying depths. This heating does not always cause actual combustion, in the sense that the coal burns with the presence of flame, though this condition is also often encountered. There does exist almost universally, however, in stored coal of this character, a slow combustion which is even more destructive than combustion by flame, owing to the fact that it cannot be so readily detected, and thus accomplishes its destructive heating quietly and unnoticed throughout an ever-increasing zone beneath the surface of stored coal. This slower escape of the valuable B.t.u.'s, for which the consumer pays his money, is equivalent to the actual loss of that amount of heating value from fire or other cause.

Could the consumer look beneath the surface of his coal pile and definitely acquaint himself with conditions existing there, he could save himself enormous losses by using that part of his coal supply first which showed a tendency to become even slightly heated.

It is for the purpose of indicating these conditions beneath the surface that the coalometer was designed. It consists of a set of temperature indicators encased in a long pointed steel tube, carrying at varying depths metal bulbs (corresponding to the bulbs of thermometers), and at its upper end a set of dials and pointers, which indicate under all atmospheric conditions the exact temperature of the bulbs which actuate them. These units are forced down into the coal pile to definite depths and at various points, and collectively furnish definite data to the consumer as to the exact temperatures existing beneath the surface. If an accurate record of these instruments be kept, periodically, the slightest rise in temperature is at once detected, and should it become excessive, the consumer at once removes this particular portion of fuel, thus saving the heating value of the coal which had started to dissipate.

Tests have shown that a coalometer installation of one unit each 50 feet in both directions from its neighbor will efficiently indicate conditions of temperature below the surface. Thus the installation of one triple unit will protect approximately 900 tons of coal if the volume is about 50 x 50 x 16 feet.

The accompanying drawing shows a triple unit coalometer for use in coal piles from 15 to 20 feet deep. A galvanized steel tube, having a hardened steel diamond point drill at its lower end, carries three pressure bulbs at depths of 5, 10 and 15 feet, respectively. Tubes from these three bulbs register temperatures in Fahrenheit degrees upon three dials, by means of pointers provided for this purpose. The scale on each dial starts at 32°F., and is colored black. At and above 120 degrees the scale is red, indicating excessive heat at any point in this zone, and warning the coal man to remove this portion of the coal. The depth of the hot spot is determined at a glance, for the dials are plainly marked 5, 10 and 15 feet, respectively. The dial showing the hottest temperature thus indicates the depth at which the heat is generating.

These dials are enclosed in weather-tight metal cases with thick crystal faces, and the set is again enclosed in a galvanized cast iron case. This furnishes ample protection when in us or in storage.

A slidable pipe wrench is provided on each unit, to aid the rapid and easy boring of the tube to the desired depth. A large, plainly-marked lug, 12 inches below the instrument head, determines the exact depth at which the coalometer is to be placed, and thus allows of no guess work on the part of the man who does the installing. The construction throughout is very rugged, and will allow of the rapid removal and stacking of one or more units repeatedly, without fear of damage to the temperature indicators themselves. These indicators are especially constructed to indicate accurate temperatures under the varying conditions encountered throughout the year. They will indicate exact bulb temperatures regardless of the temperature of the head of the instrument and will retain their calibration under conditions of extreme vibration or violent shocks.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

Our Navy and the Japanese Bogy

MORE than once since the armistice, the SCIENTIFIC AMERICAN has drawn public attention to the fact that, although in agreement with our history and traditions we are the protagonists of disarmament, and have proclaimed ourselves to be the champions of right and liberty as against might and enslavement, yet these same United States are today the only country in the world, with the exception of Japan, that is engaged in warship construction. Moreover, our plans for development are upon such a stupendous scale that we have no less than eighteen capital ships under construction, all of which are of far greater fighting power than those of any other nation.

When the great conflagration burst forth in Europe and some of us urged that we should at once strengthen our naval forces, the Secretary of the Navy, it will be remembered, deprecated strongly any such action. Today, the mighty military orgnization which broke the world's peace in 1914 has been disrupted, its arms destroyed, and its fleet sunk at Scapa Flow or distributed among the victors. Nevertheless, a secretary who, when danger confronted the country refused to make preparation, now, when the threat has absolutely vanished, would not only carry on the huge program of armament devised for a sudden war emergency, but he would even add to the battleship program which we now have in hand.

The SCIENTIFIC AMERICAN can never be accused of favoring a weak-kneed naval policy, or one that carries any color of pacifism. For a quarter of a century we have urged that the United States should possess a navy sufficient for her security and commensurate with her dignity; but we possess some sense of proportion, we hope, and the present situation that this country of all free countries should be engaged in huge military constructions at a time when others have abandoned them, seems to be both illogical and inconsistent with our own national principles.

If we wish to possess the biggest navy in the world just for the fun of it, well and good. But if this determination to build the biggest of all navies, which was first announced in an oratorical flight by President Wilson at the time when the growing wave of enthusiasm aroused by the preparedness movement was at its height—if this resolve, we say, is serious, the question arises—having this big fleet, whom do we wish to fight, or who on earth is it that is wishing to fight us? It can scarcely be Great Britain, for, in spite of our announced determination to build a navy bigger than hers, she has not only ceased all battleship construction, but has broken up three or four very powerful battle-cruisers which were under construction. Evidently, she regards the growth of our navy with perfect equanimity and is satisfied that, the Irish question and a certain type of hyphenated Irish-American notwithstanding, America as a whole has no hostile purpose back of her naval expansion.

This brings us to the question of the so-called Japanese threat, that bogy which owed its inception largely to the activities of Captain Boy Ed, the notorious naval attaché, and is now being trotted forth and dangled before the eyes of the citizens of the United States, whenever the Japanese immigration problem flares up a little more than usual in California. Boy Ed, of course, was merely drawing a red herring across the trail which led straight to Wilhelmshafen and the Kiel Canal—the more our Navy Department could be led to contemplate a bogus peril in the Orient, the less thought would it give to the very real peril in the Occident.

We call it the Japanese bogy for the reason that if there is one thing more than any other which the very wise and far-seeing statesmen of Japan regard as altogether out of the question it is that of an attack on the United States. They know full well that, so great is the preponderance of our naval strength that the issue of a naval war would be a wiping out of their fleet as complete as that which befel the German Navy.

The Tragedy of Our American Forests

CONSPICUOUS among the abundant natural resources of the United States are, or rather were, the vast forests with which our forefathers found the virgin soil of their future country to be covered. There is a universal tendency in human nature when it finds itself surrounded by superabundance to make a lavish and wasteful use of the resources thus presented, and in this the pioneers who went out to possess the country were no exception. They selected for their use that which came most ready to hand, and what they did not use they allowed to run to waste.

It would be unjust to censure our forbears, whether pioneer or lumberman or farmer or miner, for this extravagance. It is doubtful if one per cent of those good people had the faintest conception of the extent to which the growth in population of the United States would reach and how the superfluity of their day might give place to the scarcity of ours—for it is a fact that at the present rate of consumption positive scarcity in certain of our natural resources is within measurable distance.

A recent report of our Forest Service reveals the disconcerting fact that already three-fifths of the original forests of the United States has disappeared. Furthermore, we are cutting our forests at the rate of 26 billion cubic feet of wood per year, and by way of replenishment to make good that loss in reforestation, we are growing less than 25 per cent as much timber as we are using, or, to be exact, we are providing for increase only at the rate of 6 billion cubic feet per year. Any one can see that there can be but one issue to such a policy, namely, the absolute wiping out of our once magnificent forests. Just what effect this will have upon the appearance of the country may be judged from a visit to some of the eastern countries that were once rich with forests but now, because of the total lack of renewal by reforestation, present a series of hills and valleys absolutely barren of timber.

This report of the Forest Service tells us that the depletion of our timber resources has not resulted primarily from the use of our forests but from their devastation. There are vast areas of forest lands that are not producing the timber crops which they could produce and should. Thus, there are 326 million acres of timber lands through which the lumberjack and the sawmill have passed which today are bearing absolutely no saw timber. Some of this big acreage is completely devastated. A part of it is partially restocked with trees which, we are told, are of inferior quality, while there are comparatively limited areas only which are growing new timber at their full capacity.

By way of remedy, the Forest Service makes the following suggestions: First, coöperation with States in fire prevention and forest renewal; second, extension of Federal forest holdings; third, reforestation of denuded Federal land; fourth, a study of the question of forest taxation and insurance; fifth, a survey and classification of forest resources; and, finally, appropriations for forest research.

Many times down through the years the SCIENTIFIC AMERICAN has urged upon the country the need for taking hold of this problem in an enlightened and patriotic manner. The time for action is already very late; but if we apply ourselves to the task with intelligence, energy and liberality, there is yet time to save these forests and build them up to some of their original splendor.

The Scientific Voter

THE first Tuesday after the first Monday in November has passed into history with the usual after-symptoms on the part of the Great American Press, varying according to political complexion. The organs that had supported the winners have pointed with customary assuredness to the vindication of their party's high moral purposes; while those whose wishes were not synchronous with the desires of the majority have as usual fallen back upon the future to reveal that they were really right all the time and that the voters will be sick of their bargain before they are through with it. There has been the usual solemn poppycock about the voters having been misled by minor bones of contention so that their verdict is not to be construed as a judgment upon what the particular scribe of the moment considers to have been the major issue; and we recall no campaign in many years in which the losers were quite so well resigned to turning over the ship of state to the winners and letting them try their luck at steering it for a while.

But all this is wholly normal. There is, however, one feature of the 1920 elections which, while in full accord with the trend of the past forty years, has this year attained a development altogether extraordinary.

Of course the whole tendency of the present-day electorate is away from the rigid party demarcation which was once so universal that the mere suspicion of not having swallowed the ticket whole was enough to make a man an outcast in the social as well as in the political community. But the persistence with which the old tradition hangs on is at times discouraging. The splitting of a ticket is not necessarily an indication of sagacious choice, to be sure; but it is at least an admission that the voter is willing to attempt such discrimination. Hence by the amount of ticket splitting indulged in rather than by our own personal impressions of its success in seating good men and rejecting bad ones must we judge the extent to which the American voter is willing to attempt the exercise of judgment in marking his ballot.

We need go no further than New York State to realize that on this ground 1920 marks an epoch. It is true that in certain previous campaigns the State officials elected have been divided between the two parties; but this has happened only in years where the vote was so close that the shift of a few thousand votes would cause the candidate for, say, State Engineer and Surveyor against whom there was local feeling in some parts of the State, to run far enough behind his successful ticket to lose out himself. It is likewise true that for several years the New York voter has been confronted with a ballot which deprives him of the opportunity of voting a straight ticket with a single X, and forces him to mark individually each candidate for whom he would vote, regardless of whether these are or are not all of one party. But this merely meets the physical problem of marking the ballot, and touches not at all the mental one of deciding how to mark it; it is still far easier to make up one's mind to vote for all the Republican or all the Democratic candidates than to form and carry into the booth and put into execution a decision to mark certain names to which the star is attached and others that follow the sign of the rooster.

The bald fact on which we comment is this: Mr. Harding carried New York State by more than a million votes; Judge Miller, running for Governor on the same ticket, registered a plurality of a mere 70,000. In round numbers, the present Governor "Al" Smith ran a million votes ahead of his ticket. That this is a great tribute to Mr. Smith's personal hold on the voters is evident; but this is not the aspect that we would emphasize. If anybody had predicted, on election morning, that anywhere in the United States any candidate could by any possibility run a million votes ahead of his ticket, such prophet would have been laughed to scorn. The thing had never been done and never would. Yet it was done; in this one State alone, at least half a million voters attempted, regardless of party affiliations, to discriminate between the candidate they wanted and the one they didn't want. We submit that this is a most encouraging sign pointing toward a future when it shall be less than ever possible to fool any great number of the people for any considerable proportion of the time.

Electricity

Telephoning Over High Tension Lines.—An Eastern gas and electric company has been obtaining excellent and quite practical results with directed radio or wired wireless over its 11,000-volt lines between Ocean City and Atlantic City, N. J., a distance of twelve miles. The terminal apparatus may be connected with any part of the electric system—the 110-volt lamp or 2,300-volt buses.

Dust and Lighting Fixtures. — When figuring on the installation of new lighting equipment it must be remembered that when the lamps become old and more or less dirty between cleaning periods the emitted light falls off about 25 per cent, according to *Electrical World*. Consequently for a desired foot-candle illumination the rating of the lamps must be about 33 per cent higher than that found necessary from calculations based on the efficiency of new clean lamps.

Again—Electrolysis.—During the past four months the Bureau of Standards reports that it has carried out in coöperation with the American Committee on Electrolysis, which represents the national utility associations, a number of somewhat extended investigations in the field of electrolysis mitigation in several Middle Western cities. This work has been confined largely and almost exclusively to the effect of pipe drainage on underground systems, especial attention being given to the possibility of joint electrolysis on high-resistance joints and interchange of current between drained systems. Some attention has also been given to the three-wire systems of power distribution and also to automatic substation installations as a means of electrolysis mitigation.

Bowl Enameled Lamps.—Rising standards of lighting intensities for increasing production in industries demand the use of larger lamps. As the size of lamps is increased there is greater brilliancy of light source and additional precaution must be taken to ensure diffusion and to avoid glare. The bowl enameled lamp has been developed for this purpose. It has a considerably lower brightness than other forms of diffusing bulb lamps and therefore gives better diffusion and can be viewed with a greater degree of comfort. When used with a reflector the enameling acts as a small semi-indirect bowl placed immediately below the filament and softens all shadows. Bowl enameling is a translucent coating of smooth white material sprayed on the bulb. It will not chip, crack or discolor and is not subject to depreciation when exposed to acid fumes, according to the manufacturers.

Something New in Selling Lamps.—We are indebted to *Electrical World* for these few words regarding a highly ingenious device for displaying lamps. A St. Louis company has built a wheel 20 inches in diameter on the periphery of which are mounted twenty porcelain receptacles. One side of each receptacle is wired to a common point inside the hub and the other side is connected to a segment of a device similar to a commutator. Energy is supplied to the wheel by means of brushes, and the brush on the commutator is wide enough to light two lamps at one time. The wiring and electrical connections are concealed in the wheel, and its support is mounted on the wall at a point convenient to the lamp counter. The lamps placed in the receptacles range in size from 10 watts to 100 watts of the types most frequently sold. Any desired lamp or two adjacent lamps can be lighted at will. With these arrangements the comparative size, style, and brilliancy of lamps can easily be shown to a customer and the order filled directly from stock.

Good Work, Italy!—Since the signing of the armistice Italy has resumed her industrial life with considerable rapidity. She has not been free from the uncertainties of radical political action, but there is every evidence that these are on the decline; Italy is at work as completely as any nation in Europe and more so than most of them. Her wealth in hydroelectric possibilities is being developed at a rapid rate. Energy for industrial purposes, while absorbed as quickly as it is produced, is extremely cheap, and in a few years it will be abundant and the whole country interlaced with transmission lines. The various companies engaged in this work are well financed and are working harmoniously in both plant and line extensions, continues *Electrical Review*. The men engaged in this business are young, energetic and capable business men, highly representative of the new spirit that has possessed the industrial life of the country. The electrification of the Italian railways now proceeding involves 4,000 miles of additional trackage. The cost of the energy is not so great a problem as the cost to the government of converting the necessary equipment, but the mileage already converted is considerable and the equipment is of a very high order.

Science

A New Science Center in Washington.—Some time ago the Carnegie Corporation of New York provided funds for erecting in Washington a building to serve as a home for the National Academy of Sciences and the National Research Council. Subsequently a number of individual patrons of science contributed a fund of $200,000 for the purchase of a site, which has now been secured. It comprises the entire block bounded by B and C Streets and Twenty-first and Twenty-second Streets, Northwest, facing the new Lincoln Memorial in Potomac Park.

Agriculture Over Frozen Soil.—One of the peculiar features of agriculture in Alaska has recently been described by the Department of Agriculture. In the Tanana Valley, the chief farming district of the territory, the average annual rainfall is only about 12 inches, which would ordinarily make dry-farming methods appropriate, but the first few crops raised after a tract has been cleared in this region get plenty of moisture from the melting of subterranean ice. In the course of a few years, however, the ice recedes to a depth of 6 or 7 or more feet, and no longer supplies moisture to the crops. It is then necessary to use machinery which will not only pack the soil a few inches below the surface and thus hinder evaporation, but also maintain a surface mulch of loose soil, which further checks evaporation.

Chemistry in the Newspapers.—The news service maintained by the American Chemical Society reports that a very gratifying amount of attention was given by the daily newspapers to the recent 60th meeting of the society, in Chicago. Although the meeting occurred in the midst of a political campaign, the Chicago papers devoted about 10 columns to it, and extensive despatches sent out by the press associations were widely and prominently printed. The technical director of the A.C.S. News Service says: "The subjects which seem the most popular to date, as far as lay journalism is concerned, are flavoring extracts without alcohol, the resolution urging Congress to pass dye legislation, hydrolyzed sawdust as cattle food, all news relating to fuel and news print paper, and the announcement that America now makes 800 rare chemicals, this last being featured on the front page of the New York *Times*."

Exploring the Upper Air in the West Indies.—During the past hurricane season in the West Indies the U. S. Weather Bureau has carried out a program of upper-air observations in order to determine what relation, if any, exists between the "winds aloft" (as winds in the upper air are now called by the Bureau) and the movements of hurricanes. Pilot-balloon observations have been made twice a day at stations maintained by the Bureau at Key West and at San Juan, Porto Rico, and at stations maintained by the Navy at Colon and Santo Domingo; while the data obtained at the Weather Bureau and Army aerological stations in Texas are expected to help in the investigation of this subject. While the chief purpose of the undertaking was to aid in the important work of forecasting West Indian hurricanes, the discussion of the observations will probably furnish much-desired information concerning the normal circulation of the atmosphere in the West Indian region.

Dr. Albert Einstein has not, according to *Science*, abandoned his chair at the University of Berlin, but he has accepted an appointment at the University of Leiden and will divide his time between the two institutions. Much interest has recently been aroused by the announcement of the German physicists, L. Grebe and A. Bachem, that they have found the shift of the lines in the solar spectrum which was the third test of the Einstein theory, the others being the motion of the perihelion of the orbit of Mercury and the apparent displacement of stars due to the gravitational field of the sun, as best observed at solar eclipses. The predicted shift is toward the red and is in the spectrum of the sun's edge or limb. By making a careful microphotometric study of three spectograms of solar absorption lines the source of which is now ascribed to nitrogen, Grebe and Bachem were able to select nine lines in the ultra-violet that are free from the contaminating influence of superposed lines of metallic origin. Expressed in terms of the equivalent Doppler effect, the final result was a displacement of 0.56 kilometers per second, which agrees very closely with that predicted by Einstein (0.6 kilometers per second). The displacements of the different lines varied a good deal, but all were shifted toward the red. It is claimed that the discordant and non-confirmatory results previously published by several investigators were due to the inclusion of lines the positions of which were seriously influenced by the superposition of adjacent metallic lines.

Aeronautics

Aerial Regulations in France.—At last the French authorities have drawn up a series of regulations covering the inspection of aircraft, the issue of pilots' certificates and the control of aerial traffic in France, and they are to be embodied in a decree to be published shortly. *Flight* reminds us that they are almost identical with the British regulations, in accordance with the International Convention.

Our "R-38".—The work on our Naval dirigible "R-38," being built at Bedford, England, is nearing completion. It is not expected that the voyage to the United States will be made before May, 1921. At that time the hangar at Lakehurst, N. J., will be ready to receive the giant dirigible. With the completion of the huge Lakehurst hangar, the United States will be in a position to construct airships similar to the "R-38."

An Airplane That Carries Its Own Shed has recently appeared in the form of the new Sablatnig parasol limousine monoplane, of European conception. This machine is provided with a folding tent which weighs about 75 pounds out of a total 2,200 pounds of useful load. When the planes are folded along the body, the tent covering rests on the leading edges and the propeller tip, thus protecting the airplane against the elements.

Flying Without the Stick Control.—By way of demonstrating the possibility of flying an airplane simply by controlling the engine and using the rudder, a French pilot recently made a flight on an 80-horsepower Morane-Saulnier monoplane with the "joy stick" tied up and sealed so that it was impossible to use it. In the presence of officials of the Aero Club of France the machine rose from the ground, circled several times around the Villacoublay airdrome and then made a perfect landing.

New Italian Dirigible.—Some weeks ago the new Italian dirigible "Roma" made a trial trip over Rome, proving her airworthiness, so to speak. The airship is of the semi-rigid type, with a capacity of 34,000 cubic meters. It has three pairs of 400-horse-power motors and can travel at from 68 to 74 miles an hour, but one pair of engines will keep up a speed of 56 miles per hour. This, by the way, is exceptional speed for a dirigible. There are rumors to the effect that the United States may purchase the "Roma" and bring it to this side under her own power. Originally, the "Roma" was intended for South America.

Wholesale Destruction.—In a recent issue of *Berliner Zeitung am Mittag* there appeared the following advertisement, which speaks for itself: "Destroyed airplane, seaplane and airship engines of different makes for sale in quantities of 1,000 to 20,000. The engines have been rendered useless and must be destroyed further by rendering the crankshafts, crankcases, cylinders, pistons, connecting rods and bearings, push rods, valve gears and carburetors useless, according to and satisfying the instructions of the Inter-Allied Aeronautical Commission of Control. All offers must be handed in before September 1, 1920. Description of how the destroying is to be carried out can be had from the ———" and the name and address follows.

Germany's Transatlantic Air Station.—From our British contemporary *Flight* we learn that the German airships which are to carry on the proposed transatlantic service, are to be accommodated in the Isle of Norderney off the coast of Prussia. One of the chief reasons for selecting Norderney is that it is convenient of access to the huge international airdrome projected for Bremen, the distance of 80 miles bringing it well within one hour's time of that air port by airplane service. Five hundred workmen are to be employed for a period of six months in preparing the Bremen airdrome, and the German government has already signified its desire to coöperate by offering a certain proportion of the official out-of-work funds toward wages with a view to securing useful work for the unemployed.

German Air Mails.—A regular air mail service was initiated between Berlin and Breslau during the Breslau Autumn Fair week, the distance between the two cities being covered in 2½ hours. The fair closed on September 11th, but the service is likely to be maintained with a view to linking up with the projected Paris-Strassburg-Prague and Warsaw air line. Another interesting development is contemplated in connection with the Berlin-Königsberg air service, continues *Aerial Age Weekly*, which is intended to extend to Reval and Helsingfors—possibly with an eye to Petrograd in the near future. The German postal authorities are also in communication with the Swiss government with a view to the early establishment of a daily air mail between Frankfort-on-the-Main and Basle. Air mails have been running daily between Berlin, Bremen and Wangeroog, and no accident has occurred.

Making the Barge Canal Pay

What Is Needed to Give New York's Waterway the Standing It Should Have

By Frank M. Williams, State Engineer and Surveyor of New York

FROM the Great Lakes there are two barge canal routes to the Atlantic Ocean; one by way of the Welland Canal, across Lake Ontario to Oswego; up the canalized Oswego River and by way of Oneida Lake and the Mohawk River to the Hudson at Troy, thence on tide water to New York; the other route is more direct and also less hazardous. It follows the Niagara River from Buffalo to Tonawanda and thence direct across the State of New York to Troy. This route is practically the same as the Erie Canal, the opening of which was celebrated less than one hundred years ago.

The Barge Canal, which is the name given all the channels in New York's new canal system, has been constructed to a depth of 12 feet and the Superintendent of Public Works is required to maintain it to that depth. To do this requires constant attention and much dredging; nevertheless the channel has been maintained at the dimensions required and there is no reason to believe that this cannot always be done without interfering with navigation or hindering the barge fleets. The locks of the Barge Canal, of which there are 35 on the direct route between Lake Erie and New York, give the controlling dimensions for the boats, because barges constructed within the limits of the lock chambers can pass through any other portion of the waterway. These structures are uniform; their usable length is 300 feet and their width 44½ feet. This does not mean that it would be practicable to operate boats 44½ feet wide on the canal for there are other controlling factors. The width in the artificial sections of the channel is 75 feet on the bottom, hence in order for two loaded barges to meet and pass at speed, their width should be something less than one-half of 75 feet, or else passing basins must be provided which would, of course, be the source of considerable delay. Other controlling features are economical considerations. It has been found that there should be a certain ratio maintained between the width of the vessel and the waterway and that this should not be materially exceeded if resistance to the movement of the vessel is to be reduced to a minimum. This ratio varies but may be taken on the average as 1 to 6. With a waterway 130 feet wide, which is the surface width of the artificial sections of the canal, a vessel should be approximately 20 to 22 feet wide. As the new locks are 44½ feet wide it can be seen that two boats of 21 feet beam can be placed side by side in the chamber. The practical length of a boat of that width is 150 feet. Therefore, four barges each 150 by 21 feet can enter and pass through the locks at one lockage.

Practical and economical factors show that barges, on a long, limited depth channel, should not be loaded to more than four-fifths of the full depth of water. This is primarily due to the requirement for a water cushion under the keel so that space will be provided which will allow the operators to maintain a proper speed with a minimum of power. For special purposes larger boats may be used and it is quite possible that as greater experience is had a larger type of carrier may be developed. One of our large shipbuilding corporations has under construction self-propelled barges designed to carry 2,000 tons of freight and it is planned to operate these as single units. Plans have also been prepared for vessels claimed to be designed for lake as well as canal purposes and one of the designers contemplates the construction of carriers 250 feet long and 36 feet wide to move in fleets of four, one being a power barge with 1,000 horse-power. Each of these barges is designed to hold 1,650 tons which would give a total fleet capacity of approximately 6,000 tons. Such a fleet would require four lockages, but it would have the advantage of being able to move safely on the Great Lakes. However, New York's waterway was designed and built as a barge canal and was not originally intended for other purposes. Many believe that the future of the waterway lies primarily in carrying out its original purpose, although they would encourage those who are attempting to construct carriers that can withstand the storms of the Great Lakes and also move through the Barge Canal. Basically, however, the proposition before the designers is one for constructing efficient canal carriers and not adapting canal boats to lake use. Authorities, in making this assertion, have principally in mind cheapness of construction, ease of movement, adaptability to freight, etc. On these grounds they advise that, for all general canal purposes barges 150 feet by 21 feet and having a loaded draft of not more than 10 feet, be constructed. These boats if moved in units of four, one being self-propelled, will move as much freight as three freight trains, consisting of 50 freight cars each and will operate at a rate of approximately 100 miles a day whereas, under normal conditions, freight trains moving low grade commodities average but 25 miles a day.

The United States Government is operating 73 barges and 21 cargo steamers on the Barge Canal. The Inland Marine Corporation has 50 barges and 10 steamers, the

(*Continued on page 553*)

1. A floating drydock constructed by one wide-awake boat-builder for the repair of damaged canal boats. It will accommodate barges 150 feet long and 22 feet wide. 2. Semi-portable revolving jib cranes installed on the Barge Canal Terminal at Pier 6, East River, New York City. 3. A typical oil tank station along the barge Canal. The Standard Oil Co. has constructed many of these, and since the Canal was completed not a single gallon of oil has been delivered to any of them except by barge. 4. Fuel-oil-burning barges with tows at the Troy Terminal. 5. Conveyor cranes of 1½-tons capacity at the New York Terminal

Some of the appurtenances that will help the New York State Canal to make good in handling its due share of freight traffic

Left: Ancient tank, believed to have been built by Pontius Pilate, now recemented and used by the British. Of the two covered pipe lines paralleling the road, one collects water from the spring-houses and the other conveys it to Jerusalem. *Right:* Egyptian labor corps working on the construction of water reservoirs

Examples of what British administration is doing for the water supply of Jerusalem

Jerusalem's New Water Works

By H. J. Shepstone

NOT the least of the many blessings which the British have conferred upon Palestine as a result of their occupation of the country is the giving to Jerusalem of an ample water supply. Before their coming the Holy City was virtually dependent upon the rainfall for its water, collected and stored in cisterns. Many of these latter were situated under the houses or at the back of the premises, and generally hidden from view. Water gathered during the rains on the flat roofs was conducted to them by pipes, and there stored until wanted. Many of these cisterns were found to be in a sad state of repair, and, what was worse, were the breeding places of many germ-carrying insects. The military authorities had them all cleaned out and repaired. Some of them had not been cleaned for a hundred years and more.

But these rainwater cisterns were not sufficient to supply the city's needs. Ever since she has been under Turkish rule Jerusalem has suffered from the lack of a good water supply. Except for one small spring, the Virgin's Fount, so named because it is believed the Mother of Christ drew water from it, Jerusalem cannot boast of a single fountain. It is situated outside the city in the Kedron Valley. True, a year or two before the war the Turks built a four-inch pipe from the old Pools of Solomon, to the south of Bethlehem, to the Temple area, but the supply was limited and for the most part reserved for the mosque. Even in Solomon's days the want of water was felt, and he obtained his supplies from three reservoirs built in a valley just below Bethlehem. From these water was brought to the city by an aqueduct.

Over and over again engineers and others offered to repair these reservoirs and build a modern aqueduct, but the Turks always turned the proposition down, or put obstacles in the way, with the result that Jerusalem had to depend upon the scanty rainfall for its water.

It was early in February, less than three months after the capture of Jerusalem, that the British began to grapple with this serious question. They went first to the Virgin's Fount and made an exhaustive study of this historic and interesting spring. As a result, they discovered that it was not an ordinary intermittent spring, but rather a fountain of the character of a geyser, for the flow occurs three to eight times a day, the output varying from 2,000 to 11,000 gallons each time. It was from this very spring that Hezekiah, over 2,600 years ago, conveyed water by means of a tunnel to the Pool of Siloam. Pipes were laid from the spring and water was pumped up to tanks in the Valley of Jehoshaphat, near the northeastern corner of the city wall.

Although this greatly improved matters, the supply was still found to be insufficient to meet the ever growing demands of the city. An examination was now made of the Pools of Solomon to the south of Bethlehem. In the end, however, it was decided to repair and use the old reservoir, now known as Birkett Arroub, lying a few miles to the south of Solomon Pools. It was built by Pontius Pilate and it was from here that he brought water to the city in the days of Christ.

Pilate's old reservoir was repaired and enlarged, its capacity today being 5,000,000 gallons. Galleries were built in various directions to tap the numerous surrounding springs, including those of Ain ed Dirweh, in which, it is said, Philip baptized the eunuch. A powerful pumping plant was installed by which the water is pumped up to large reservoirs built on higher ground on the Hebron road, the water flowing from here by its own gravity in a one-foot iron pipe to twin pools on the hill west of the city, from whence it is conducted to various stand-pipes in and around Jerusalem.

Pilate's aqueduct, ruins of which dot the landscape today, stretched for a distance of forty miles, though as the crow flies the Holy City lies but thirteen miles away. The British pipe line, however, is but fifteen miles in total length. As a result of this enterprise the death rate in the city has dropped by one-half.

Light Burning in California Forests

By Charles P. Fryer

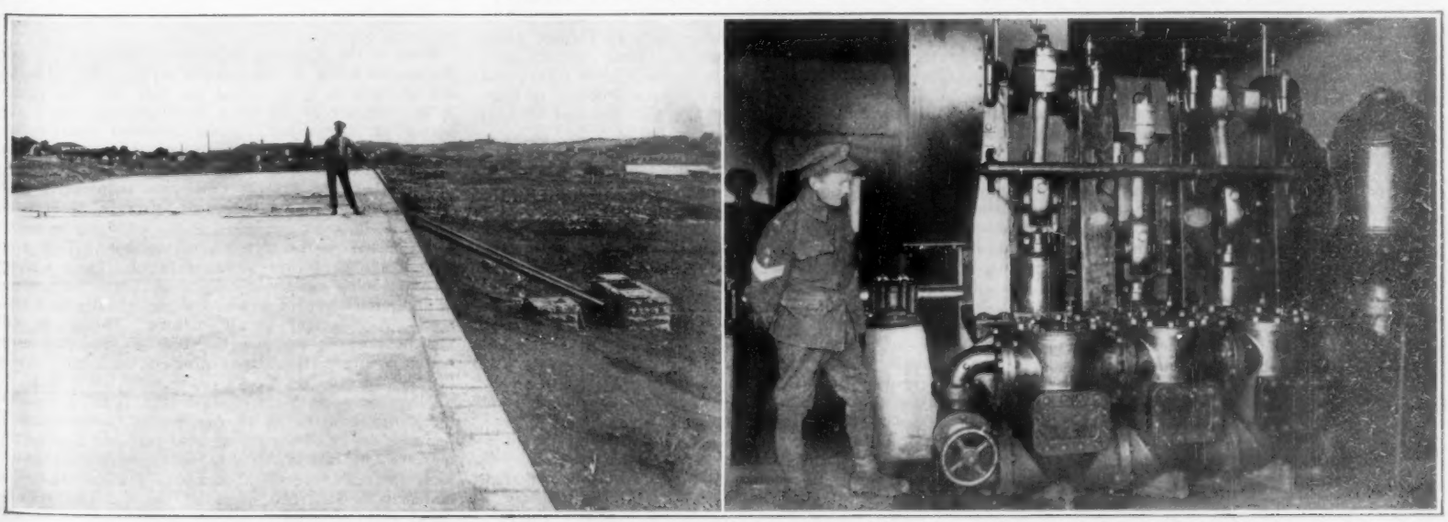
STANDING redwood trees are almost immune from forest fires and this fact necessitates a distinction between the redwood and pine forests in California in any consideration of light burning, a test of which is advocated by the California Forest Protective Association and other private associations and lumbermen for the sake of clearing the forest floor of debris and thus preventing big destructive fires.

In the redwood forests slashings and underbrush occasionally cause fires hot enough to burn to the tops of redwood trees, destroying their branches and foliage but in nearly every case they put out new foliage the next season. This immunity of redwoods to fire is due partly to the climate of the redwood region and partly to the absence of resin in the wood and its thick non-combustible bark.

The primary pine region extends from the Oregon line south through the Sierra Nevada Mountains following closely the line of winter snows and being 2,000 to 3,000 feet above sea level. The timber is in open, park-like stands and in early days the forest floor was kept clear from brush and litter by the light burning practised by the Indians and the occasional fires caused by lightning. The trees passed through several centuries of these fires to make splendid timber.

In these days of close fire prevention and control a rank growth of underbrush has sprung up in California pine forests and there is much debris in places. This causes hot fires which are hard to control and often burn mature trees.

Fire tends to prevent fire as is shown by the small timber losses of 1912 and subsequent years, following 1910, in which year forest fires were the most disastrous known for years in California. Since 1915 the loss each year has been greater than the season before, increasing from less than 2 per cent of the 1910 loss in 1915 to over 60 per cent in 1919, thus showing that the underbrush is accumulating.



Left: Top of the water tank constructed by the British military authorities in Jerusalem. *Right:* Interior of the pumping station at Arroub

New construction by means of which Jerusalem is freed from dependence upon casual sources for her water

One Hundred Years of Gas Lighting

An Account of the Early Days of This Art, Which First Stood on Solid Ground in 1820

By William Ressman Andrews

THE centenary of illumination by gas practically falls in this year. Eighteen hundred and twenty was the dividing line between the experimental stage of gas lighting and the period of its demonstrated practicability. The history of its expansion is similar to other discoveries in physical science which have developed factors now recognized as fundamental in the advancement of modern civilization.

As in the case of steam and electricity, its practical application to everyday use came long after the researches of the original investigators. Although this general recognition was somewhat tardy at first the progress made in gas lighting was rapid from the time, in 1820, that its merits became thoroughly established. Street illumination by gas was introduced in Paris by Frederick Winsor in that year and thenceforth was extended generally throughout Europe. He organized, some time before, the first gas company in London and was known from the successful culmination of his Paris venture as the "father of modern gas lighting."

In America, too, the feeling, that gas—introduced in Philadelphia and in Baltimore in a tentative way and with some misgivings at an earlier date—had proved to be a practical means of lighting, began to take strong hold on the public mind in 1820. An important improvement which increased the popularity of the new illuminant was made in this year. This was the invention by J. B. Neilson of the Glasgow Gas Works in Scotland, of the "fishtail" burner, or union jet, which gave greater luminosity to the flame. Furthermore it was largely this year which saw the fruitful efforts of scientific men who, having realized the boon of gas lighting, had set forth its advantages in their writings.

Chief among them was Fredrich C. Accum, a Westphalian chemist, living in London, who had published a short time before a "Practical Treatise on Gas Light." This epoch-making work on the subject was immediately translated into French, German, and Italian. The municipal authorities of the continent were at once impressed with the fact that they now had the means at hand to lessen considerably the dangers which from time immemorial had lurked in their streets and alleys after nightfall.

A high degree of pioneer activity characterized the experimental and promotion period. Passing over the earliest events connected with the subject—such as the fitful industry of an ecclesiastical dilettante in England who amused himself by filling bladders with the fumes of coal distilled on the hearth of the rectory kitchen—it was reserved for the experiments of a Scotchman, William Murdock, to point the way to the possibilities of a new illuminating agency. He was the first to show that gas could be made on a large scale for lighting purposes. The experiments were conducted near the close of the eighteenth century at Redruth, Cornwall, where his house was lighted at first by a flame emitted from the crudest form of jet—or rather the absence of a jet. The gas was consumed as it flowed from the open end of an iron pipe. The gas consumption was of course out of all proportion to the volume of light obtained. But he checked the waste by welding the orifice and then boring three small holes in a way to produce three divergent flames. There was now less gas consumed, but the light was poorer. In the next step Murdock flattened the end some little distance down the pipe and bored a number of holes close together along the top. This arrangement produced a series of flame spurts which greatly increased the illuminating power of the burner, called, on account of its shape, the "cockspur."

Shortly afterward the scene of his experiments was transferred to England. The engine factory of Boulton, Watt and Company, at Soho, near Birmingham, was lighted with gas by the Scotch inventor. Its successful application here revealed the fact that the ubiquitous candle and its pushing rival, the whale oil lamp, would be obliged in time to give way before the acknowledged superiority of the new illuminant.

The stage of development which followed was marked by the introduction of a saw-cut across the top of the welded end of the pipe to take the place of the row of small holes. As a result the gas burned in a sheet of flame resembling a bat's wing, and this form of burner was on this account known by that name.

Murdock's later experiments included the adaptation of the principle of the Argand burner, which had a ring of holes at the top of a hollow cylinder through which the air circulated. The draught passing through the center of the cylinder was necessary to insure proper combustion; also the flame, to be of any service, had to burn without flickering, and these requirements were obtained by the use of a chimney.

At first iron tips were employed in the flat flame and the Argand types, but they were soon discarded for tips composed of steatite and similar substances. This improvement came about when it became known that the light intensity depended upon the degree of heat in the flame. Hence the use of non-conducting material for gas tips to keep as much of the heat as possible in the flame itself.

The improvement made by Neilson over these jet forms was based on a simple process. He discovered that the light burned much brighter when two streams of flame were made to strike each other squarely. The impact spread the blaze out into a flat flame. The burner in a short time was universally adopted. The use of clay retorts and the introduction of sulfate of iron as a purifier are other contributions made to the progress of gas lighting by this Scotch mechanical genius.

In another method of purifying gas lime purifiers were employed, the invention of Samuel Clegg, who contributed to an elaborated treatise on gas making brought out by his son in 1850, a volume which proved to be of great value in spreading information as to the advantages of gas lighting. The elder Clegg was also the inventor of a water meter for measuring gas. His device has proved to be the basis of the improvements since made in gas measuring methods.

ONE of life's little ironies for the editor of a sheet like the SCIENTIFIC AMERICAN *is the frequency with which he is asked to state name and date for an "invention" which in reality was not at all a single invention by one man, but came rather through a long series of experiments and semi-commercial developments by many men. If we name the first of these men as the inventor, we are immediately challenged to show just what he invented; if we name the last, we are driven into a corner and compelled to acknowledge his indebtedness to all his predecessors. With all this in mind, it was with considerable diffidence that we followed Mr. Andrews into his effort to establish 1920 as the centenary of gas lighting. But we believe all readers will agree that he has made out a passable case, and that he is entitled to say that the present year comes about as close as any year can to rounding out an even century of this style of illumination.*—THE EDITOR.

The year of Neilson's discoveries which evolved the union jet saw the introduction of gas in Boston, and in 1823 there were twenty-three cities in Europe using gas. Berlin, the city from which so much "natural gas" about world dominion was to escape later on from royal lips, began to illuminate its streets and houses in 1826. Dresden followed in 1827 and by 1850 gas had been introduced into twenty-six German cities.

The use of gas in Baltimore dates from 1816; New York, 1823; Brooklyn, 1825; Boston, 1828; New Orleans, 1833; and Cincinnati, 1840.

The New York date is associated with the name of a family long prominent in the business and social life of the city. In that year Samuel Leggett organized the New York Gas Company. It was incorporated at $100,000 and obtained a 30-year franchise to lay pipes south of Grand Street. In September they were laid in the principal thoroughfares and were very different in appearance from the huge metal mains we are accustomed to see nowadays. Wooden logs, laboriously pierced by the primitive tools of the period, and tapering at the ends, served to convey the gas to the point of use. Leggett's house, at 7 Cherry Street, was, according to tradition, New York's first dwelling to be lighted by gas. In 1825 Broadway from the Battery to Canal Street was added to the gas illuminated area.

At that early day in the history of the industry in America, coal was not used for the distillation of gas, except in the anthracite regions. Coal was being shipped from Newcastle and Liverpool and the expense of such importations put coal far beyond the reach of the gas manufacturers who might have been considering its use outside the anthracite sections. Leggett's company distilled its gas from resin, which in his time was cheaply transported by water from the South. The gas fixtures and burners were not made in this country at that period but were brought over from England.

A great advance in gas lighting was brought about by the introduction of the atmospheric burner in 1855, the invention of R. W. von Bunsen. It marked an important stage in the history of gas because it made possible the use of coal gas for heating and cooking purposes.

But a more important invention came from the hands of a man who had been a student under Bunsen—Karl Auer Welsbach, whose burner, known the world over by his name, has achieved a striking and impressive distinction. According to Prof. H. Bunte, in a paper read before an International Gas Congress in Paris, a short time after the Welsbach burner had been introduced in 1886:

"The Welsbach lamp is now the recognized form for both private and public use; the older types are continually losing ground. It has effected a complete revolution, not merely in regard to the illuminating effect and the economy of gas lighting, but even the fundamental factors by which gas is valued and the properties and the manufacture of gas have been entirely altered."

The inverted incandescents, a development of the Welsbach principle, first made their appearance in 1900, and proved to be more satisfactory than the upright lamps. Another strong point in the appeal made by the lamps burning in reverse order was their adaptation to decorative treatment.

When Professor Bunte addressed the Paris assembly the Welsbach light seemed to be the last word in illumination, and yet it was the dawn of an inconceivably greater illuminant — electricity. While electricity is superior to gas in one respect, it may be asserted confidently that gas will hold its own for some time with overworked housewives, who for the last decade have been relieved from the drudgery and uncertainty of the coal range.

Attractive Farm Signs

ONLY a few years ago the signs encountered in a farming district were all of clothiers, hardware houses, druggists, and other city stores, or of tobacco manufacturers, medicines for man and beast, baking powders, and the like. These varied interests saw an advertising opportunity in placarding the countryside with metal and wooden signs. But times have changed. The signs one now sees in growing number are more and more the farmer's own, designed to convert to his own use such advertising opportunity as exists.

Some of the signs are to advertise products for sale, the appeal being to the passing auto traffic. Another use of signs is to advertise the fact that the farmer is the member of the local farm bureau, and a supporter of its project. Some Western districts are using the farm sign, or are planning to, in a campaign to displace the scrub animal.

The other day a large California coöperative association, the Prune and Apricot Growers Association, placed a big order for baked enameled signs, in colors, to be posted on the orchards of members. This association will need over 10,000 to begin. These snappy, up-and-coming signs will help to maintain the prestige of the association at home, and incidentally will be a good advertisement to all visitors. The prune and apricot growers are not the first to use them—the raisen growers, the citrus growers, and the walnut growers already do.

Thus we see that the roadside sign is not disappearing, only changing in character. It becomes now a business device of the progressive farmer. And in this new use, ultimately, it is to be expected that it will lose the ugliness which formerly always was associated with it. The users of the old-time country metal sign were indifferent to its appearance, so long as it "advertised." Farmer-users won't long be.—By *J. T. Bartlett.*

Tuning and Testing

How the American Automobile Engine Is Limbered Up and Tested for Flaws

By George Gaulois

THE best grade of American manufactures of all kinds are today meeting severe tests with complete success. The higher quality of American watches excel the Swiss product at one-third the price. American machine tools lead, not only because of their ingenuity and cheapness, but because of their excellence. And American automobile engines, in spite of the glamor which with some people still hangs about the word "imported," are equally superior in spite of the far larger numbers produced and the far lower price.

In this story we are dealing with American automobile engines produced by the quantity production system.

Aside from the test which comes from actual experience, the best data can be obtained on the performance of any engine by an inspection conducted on the dynamometer. This method of testing is used to a greater or less extent in all the high grade automobile establishments in America. Its operation gives vivid example of the reasons for the superiority of the American engines.

In one leading plant, for instance, every engine turned out must pass the dynamometer tests. In spite of the most careful work in the manufacture of parts and most careful assembly, an engine, whether made by European or American processes, is so "stiff" that it is practically useless when completed. At that stage it is barely able to run itself and far less to propel a vehicle. The engine testing combines the functions of taking the stiffness out of an engine and that of reserving its quality to the most minute detail.

When the engine first comes from the assembly, it is put upon what is known as a "lapping-in stand," where it is driven by an electric motor until the internal resistance is reduced to a little above four horse-power. With the cheaper grades of engines, this "lapping-in" with a general inspection of the engine is all that is required and it then goes into the car. With the higher grade engine, the tests have merely begun at this point.

When a motor is taken from the "lapping-in stand" where it has been tested in thirty-six points, it is carried to the "silent rooms." These are completely enclosed so that no outside noises will prevent the detection of the most delicate fault in the engine. In this room is the dynamometer, which consists primarily of a generator mounted on bearings so that it may turn easily but attached to a scale so that it will not turn but the amount of torque will be measured accurately. Besides this, there is a tachometer which gives the number of revolutions that the engine under test is making per minute.

From these two instruments can be calculated exactly how much horse-power is being developed. If, for example, the scale shows a turning impulse of 111.1 pounds and the tachometer 2,000 revolutions, the formulæ show that the engine is developing seventy-four horse-power.

The other furniture of this room includes the switchboard, the jack for the motor and the pipe connections for oil, gasoline, water, etc. There are special instruments provided, including thermometer, compression clocks and a stethoscope.

The engine here is put through a series of 114 different tests. These cover the operation of the engine itself, of all its accessories, of the crankshaft assembly and of the transmission. In making them, the engine is run under its own power until it is thoroughly warmed up and the tests are then made under conditions which are almost exactly those of actual work.

The minor details of the engine are examined first, including the spark plugs, the valves and their timing, the ignition and feed system, the carburetor adjustment, and a general examination to make sure that there are no leaks in any of the water, gas or oil lines or in cylinder heads or crankcase.

The more important and delicate of the tests is made with the stethoscope, as shown in our current cover illustration. This differs from that used by a doctor only in the fact that it has a brass cone instead of a diaphragm disk. The point of this cone is moved over the motor inch by inch, and with it the tester can detect and locate noises which are entirely beyond the reach of the unaided ear. The use of the stethoscope is a comparatively recent development. In the old days, the tester hunted for these faint noises with a screw driver, holding the bit against the engine and the handle to the ear.

The noises which are detected in this way indicate trouble in embryo only There is no possibility that the buyer of an engine would detect them if the car were sent out without this inspection. But they all denote some weakness which might develop after the engine had run some thousands or tens of thousands of miles, and the pains taken to find and correct them gives insurance of long life and perfect performance by the engine.

If this test is made without trouble being detected, it has been made doubly certain that the engine is as near perfect as possible and far more perfect than nine out of ten of the best jobs that can be turned out by the hand-fitting process.

The test of the engine has not been completed, however. Following the stethoscope examination, the "power curve" is taken at 400 revolutions a minute, then at 500 and so on at every hundred up to 2,000. The engine is then set for 1,000 revolutions and there is another stethoscope diagnosis for troubles that may possibly have developed through the hard work done. Transmission and auxiliaries are then checked for noise, lost motion, amount of play and all other possible ills. No motor may be passed that suffers from what the instruction sheets describe as "vibration, knocks, growls, or rumble."

The engine is then tested for compression. A special gage is shoved into priming valves to try the compression of each cylinder separately. On this engine a difference of only five pounds in the compression of each of the twelve cylinders is permitted. If an engine

(*Continued on page 555*)

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Finger Nail Phonograph

To the Editor of the SCIENTIFIC AMERICAN:

The following odd discovery in connection with phonographs may be of interest, and if published, may lead someone along new paths of inquiry:

If the nail on the forefinger of the right hand be slightly sharpened and filed, so that it will fit into the groove of a record while in motion, a faint reproduction of the record may be obtained. The sound is very minute, and the best method of hearing it is to lay the right ear against the hand. In this way the record can be clearly heard and the words of a song can be easily distinguished.

It would be interesting to know the reason for this peculiar phenomenon, and perhaps some anatomist or scientist may be able to supply a solution.

If a needle be held between two fingers no sound is heard.

Ottawa, Ont. R. E. SNEYD.

Movie Science

To the Editor of the SCIENTIFIC AMERICAN:

The moving pictures are no whit behind the newspapers in the matter of highly original contributions to science. There was recently exhibited in this city a picture showing a diving bell, by means of which submarine photographs could be made. After showing the bell suspended slightly above the deck of a steamer, with the photographer crawling in under it, then being lowered into the water, the following illuminating explanation was flashed upon the screen.

"The diving bell has no bottom, the water being prevented from entering by the vacuum which is formed."

Surely that must have been a powerful vacuum! Hereafter, in order to prevent burglars from entering my house I shall remove the massive oak door and block up the doorway with an empty space. Sir Oliver Lodge tells us that the ether which fills all space, whether otherwise occupied or not, has a density of a thousand tons per cubic millimeter, and a tensile strength of 10^{22} tons per square millimeter. That ought to stop something.

Los Angeles, Cal. M. C. MOTT-SMITH.

The Hudson River Crossing

To the Editor of the SCIENTIFIC AMERICAN:

I read with great interest in the latest edition of your most useful paper an article on the probable effect of CO in the tunnel to be built under the Hudson.

The true solution is a bridge over that river. While the best terminals for that bridge would be the Palisades and the hill at 10th Avenue and 62nd Street, the problem of foundations will have to govern the site of the bridge. I believe the Pennsylvania Railroad tunnels rest on caissons which in turn rest on bed rock, showing that in some parts of the Hudson caissons can be sent down to rock.

Permission for these foundations and piers must be obtained from the War Department and herein lies the real difficulty. To persuade that monument of conservatism to grant permission for such a great public improvement seems hopeless. However the attempt should be made. Only by an overwhelming public demand can anything be done.

On such subjects your journal is the most influential paper published and I hope you will make the attempt to start public opinion in the right direction.

New York. F. A. DE PEYSTER

Postponing Payment

To the Editor of the SCIENTIFIC AMERICAN:

Referring to your editorial on "Our Surplus, Our Ships and Europe's Need," I would inquire how these surplus commodities of a value of two billion four hundred million dollars are eventually to be paid for? This is the difficulty, for temporary means to finance the transaction are quite simple. The problem is, with reference to the payments in the future.

The ten billions which you say we have loaned Europe probably refers to the moneys loaned by the United States Government to the governments of Europe and as this money was spent in winning our war, there is some question as to whether it will ever be paid. But in addition, the countries of Europe owe to individuals in the United States about five billion dollars, and the interest on this debt must be paid, and unless the money is permanently invested in Europe, the principal must also be returned. If in addition to the five billions we add two billion four hundred million, it will mean that Europe must send to us in interest five hundred million dollars or more a year, and as there does not seem to be much chance of Europe shipping gold in such quantities, we must make still further investments in Europe, if we do not accept merchandise in payment of the interest. In other words, to the extent of this interest, our imports from Europe must exceed our exports. If the principal is to be paid and not invested abroad, the value of our imports over exports must be even greater. Should the interest be invested abroad, we will only postpone the day when we will be obliged to accept great quantities of merchandise as interest on our loans.

Tenafly, N. J. EVERARD B. MARSHALL.

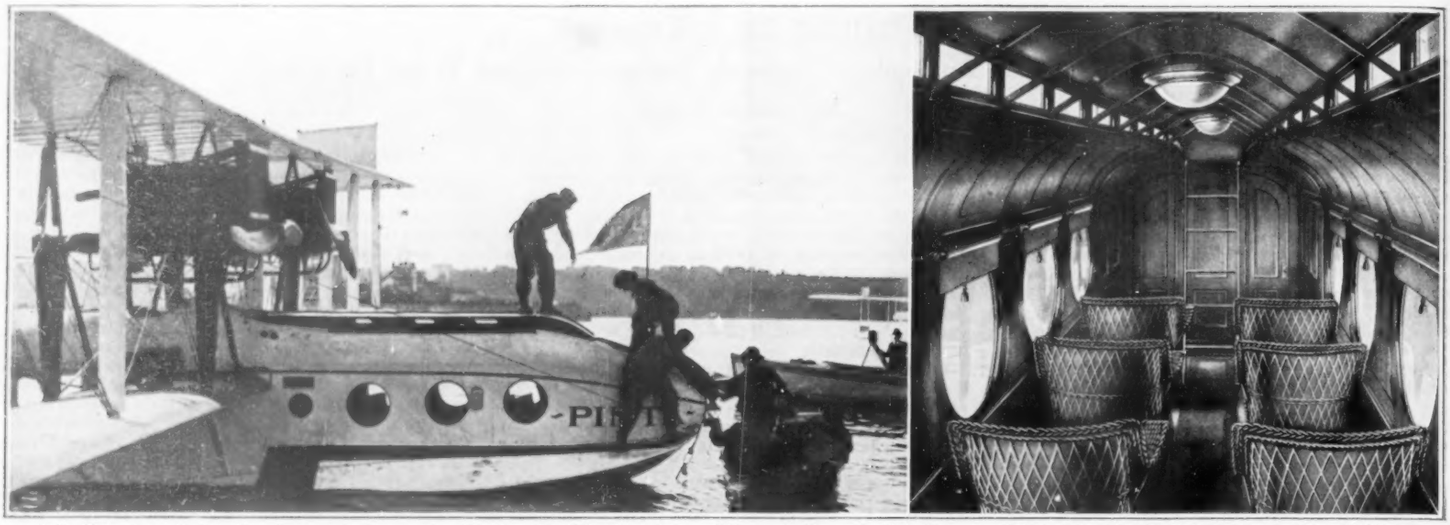
Use of Light for Reproducing Sounds

To the Editor of the SCIENTIFIC AMERICAN:

Referring to a note on page 402 of your issue of 16th October, I may say that the idea is *not* new, having been worked out in practical form 20 years ago and patented by Prof. Ernst Ruhmer (see his book on Wireless Telephones). I myself worked out the full details independently of him but went no further to popularize the matter when he took out his patents. About 5 years ago as his patents were expiring, I tried to interest a New York film manufacturer and he referred me to a talking machine manufacturer who referred me back, and as I had other things to do I had no time to go further.

I may add that in my own design I used what I think an improvement, viz., a semicylindrical lens to give the line image on the film. I had noted for experiment many points such as the use of heat rays and also the use of ultra-violet rays (for example as promoting discharge between terminals). Possibly, as the matter seems again arousing interest some note of a fuller character by you would interest the public.

Victoria, B. C. D.



Left: Near view of the "Pinta," showing the roomy cabin, the twin Liberty engines, and the navigating cock-pit to the rear and just above the cabin, between the engines. *Right:* Interior of the passenger cabin, showing the plain but comfortable appointments

Two views of the "Pinta"—one of the flying units employed on the Key West to Havana air line

The Dawn of American Commercial Aviation

Why We Have Trailed Behind Europe and How We Hope to Catch Up in the Near Future

By Ladislas d'Orcy, M. S. A. E.

THERE is no use mincing words: the American aeronautical industry is decidedly at a low ebb. Following the Armistice and the suspending of heavy Government orders for airplanes of all kinds, our aircraft manufacturers found themselves with a large stock of raw materials and expensive plants, with little or nothing to do. In other words, we in America had nothing to take the place of wartime flying. Meanwhile, Europe forged ahead in commercial aviation. Although we were the first to introduce winged mail, Europe has eclipsed us beyond a doubt. And Europe has done remarkably well in commercial aviation. We are a considerable distance behind, true; but it is with some satisfaction that Americans at last can rest assured that a start has been made in American commercial aviation, and that a practical way has been found to make such ventures profitable. This is the story which we have asked Mr. d'Orcy, a well-known authority on American and foreign aviation, to tell our readers.—THE EDITOR.

A SIGNIFICANT ceremony took place a few weeks ago at the Columbia Yacht Club, on the Hudson, in New York City, when Rear Admiral Glennon, commander of the Third Naval District, raised the American flag on two large Aeromarine flying boats constructed for a daily mail and passenger service between Key West and Havana. This act truly marks, as Charles F. Redden, president of the Aeromarine Engineering and Sales Company, remarked in his inaugural speech, "The first constructive step in the history of American rapid transportation toward the creation of regular passenger air lines such as are operating in Europe with marked success."

Although the first country to start the operation, in May, 1918, of regular air mail services, the United States was later outstripped in commercial aviation by England and France, in which countries numerous passenger air lines have been organized since the armistice. America's tardiness in taking advantage of the latest means of rapid transportation may in part be justified by the fact that while the British and French Governments accord various kinds of direct or indirect financial assistance, until recently nothing of the sort was forthcoming from our own Government. Lately, however, the Post Office Department decided to supplement its own air mail routes by letting out contracts for the carrying of mail by privately owned aircraft.

This commendable policy affords air transport firms just the kind of indirect financial assistance they require for making commercial air service a sound business proposition, and the organization of the Key West to Havana air line is its first practical result.

It may be asked why air transport companies should require government assistance. The reply is that the organization of "airways"—as commercial air services are now referred to—demands a considerable capital outlay, firstly, because of the extensive "ground organization" required, and secondly, because at the present time airways can be made commercially sound only if a certain amount of pay load is guaranteed. Just as the merchant marine could not operate its ships without adequate harbor facilities, no airway can be run without airports, emergency fields, fuel depots, repair shops, aerological and radio stations, etc. Now all this ground organization hardly exists in this country, whereas in Europe the governments have undertaken this work as a matter of public utility.

On the other hand, the problematic nature of the pay load is due to the fact that the "aerial traveler" represents an economical factor that has yet to be created.

This is what the Aeromarine West Indies Airways set out to do when they decided to carry passengers in addition to the 500 pounds of mail they are under contract to transport daily between Key West and Havana. The service is operating with a fleet of six twin-engine flying boats, three of which bear the names of Columbus' caravels—"Santa Maria," "Pinta," and "Niña." This type of commercial seaplane was developed by the Aeromarine Plane and Motor Company of Keyport, N. J., from the famous "F-5-L" class of naval aircraft which the United States Navy produced during the war in response to the German submarine menace. Owing to their large carrying capacity and reliability, these flying boats were able to carry important loads of bombs over great distances and thus became largely instrumental in clearing the Allied sea lanes from enemy underwater craft. Since the armistice an "F-5-L" seaplane established a new world's endurance record by remaining in the air without alighting for twenty-four hours and nineteen minutes—a performance which will give the reader an idea of the possibilities of these machines.

The reconstruction of the "F-5-L" type into a mail and passenger carrier consisted mainly in reducing the fuel capacity from ten to four hours and in equipping the hull with two comfortable cabins seating six and five passengers, respectively. The cabins are situated one forward and one aft of the wings and are furnished with comfortably upholstered reclining chairs from which the passengers can gaze upon the underlying panorama through regular portholes fitted with curtains. Altogether the accommodations are fully comparable with those one expects to find on a large sized motor boat or in a limousine. A passageway inter-connects the cabins, which are reached from the deck through two hatches. A sliding door furthermore allows direct access to the after cabin.

Amidships, and raised over the roof of the cabins, is situated the central cockpit, which can accommodate a crew of four men and holds a dual control set, the necessary instruments, and a radio outfit with a two-way range of 50 miles.

The weight of such a flying boat, fully equipped and including the water for the radiators (226 pounds) and emergency provisions, but excluding fuel, oil, crew and pay load is apportioned as follows:

	Pounds
Hull and fittings	2,340
Wing and tail structure	2,613
Machinery	3,136
	Pounds
Navigational	150
Radio	160
Electrical	57
Total	367
Total net weight	8,456

The "Santa Maria," another of the flying units of the Key West to Havana air line

(*Continued on page 555*)

A Canoe That Travels Over Roads

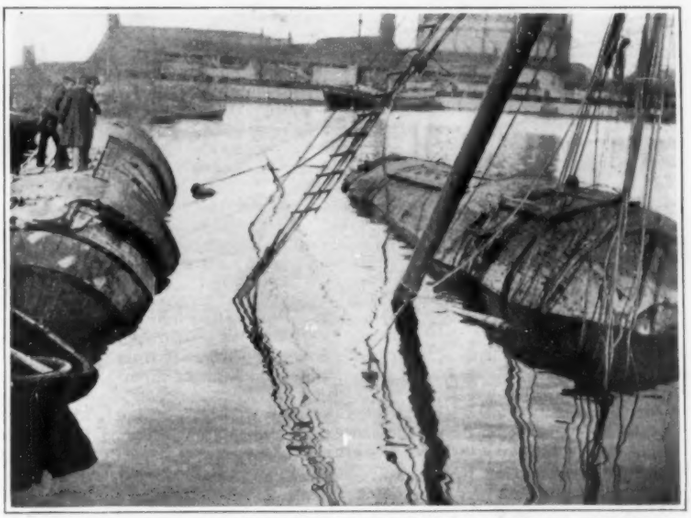
AT the recent canoe regatta held in Grunau, Germany, not so long ago, the canoe-automobile shown in the accompanying illustration attracted no little attention. This machine is nothing more than a standard canoe mounted on light automobile chassis. Holes have been cut out of the bottom of the canoe in order to bring through the steering post and dashboard connections. The emergency brake and the gear-shift levers have been left outside, in accordance with the standard European practice. All in all, this may be called a canoe which travels over roads, for it is still a canoe so far as shape and seating arrangements are concerned.

These German watermen have mounted a canoe on a light automobile chassis

Glass Windows for the Salvage Pontoon

DAY by day we learn of something new in the way of salvaging equipment and methods. And naturally enough, for never has there been so fruitful a field for the imaginative mind and the inventive genius as at present, when the seas are liberally dotted with wrecks which await the operations of enterprising salvagers.

From Denmark comes the accompanying view, showing a pair of aluminum pontoons equipped with glass windows. An interior chamber runs the entire length of these cylindrical pontoons, which are pointed at each end. A portion of each pontoon is provided with stout planes of glass, which, presumably, are of sufficient strength to resist the heavy pressures brought to bear on them by water at even small depths. The occupants of these pontoons are provided with powerful electric lights so that they can see the progress of the work under water, and direct the divers in attaching hawsers and doing other tasks. The lifting power of the pontoons, which must be considerable, is also depended on for raising the sunken object.



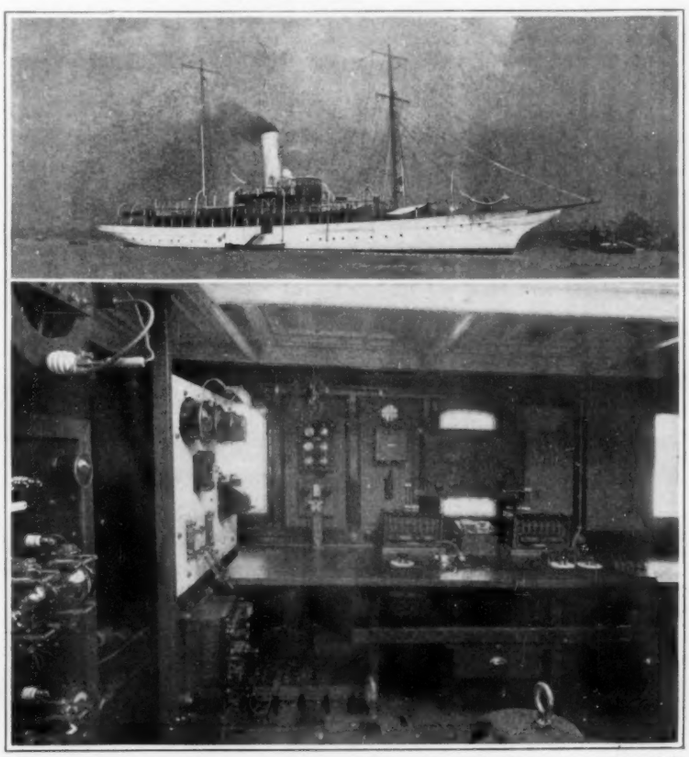
Glass-sided pontoons that have been constructed in Copenhagen Harber for certain salvaging operations

Marconi's Floating Laboratory

MARCONI, as a great inventor, runs true to form: he is indefatigable in his researches and improvements and new ideas with regard to radio communication. Not content with having laid the foundation for practical wireless telegraphy, he has continued year by year in the marvelous development of radio communication.

In this connection the yacht "Electra" is of cardinal interest, for it is aboard this private vessel that Marconi does much of his research work. Our two views show the yacht and the wireless laboratory aboard it. A vacuum tube transmitter for undamped wave transmission, suitable for radio telegraph and telephone messages, appears at the extreme left, followed by a power switchboard. The long table contains vacuum-tube receiving and amplifying apparatus, as well as delicate instruments for making quantitative tests of the received signals. In the center foreground may be noted the very tops of a motor-generator set.

We have it from British sources that Marconi has recently been experimenting with radio transmission and reception of extremely short waves, which can be reflected by means of special reflectors in very much the same manner as light waves. The famous inventor is said to be experimenting with a view to using these short radio waves in foggy weather, when one ship can detect the presence of another ship by picking up these short waves and getting the direction of their source. The receiving device will be in the nature of a rotating mirror, which will 'stop' when radio waves strike it head on, thus giving the direction.



The steam yacht "Electra" and Signor Marconi's radio laboratory aboard it

Utilization of Refuse Slate

RECENT developments in the recovery and utilization of waste slate have led to the extension of processes for the production of paints, distempers, putty, brick, blocks, slabs, tiles, mortar, plaster, flooring, rubber, and molded goods. A firm in North Wales now claims to be able to build and decorate a house with slate waste, with the exception of woodwork, glazing, ironmongery, and plumbing. An article which appeared in a recent issue of the *Stone Trades Journal* contained the following particulars:

To find a use for the slate waste of the quarries is a problem that has occupied the minds of those interested in the slate industry since slate superseded tiles as the roofing material, which is upward of 300 years ago; but at no time has this subject been of so much importance as it is likely to be in the very near future. The slate trade is at present booming, but the boom is not likely to be everlasting. When things slacken in the building industry and when foreign competition has again to be met, prices are likely to drop from their present high level, and an outlet for the waste of the quarries would go far to assist the owners to stand the reduction. It has also to be borne in mind that the rock in many of the important quarries is deteriorating; this is a very serious matter for the quarry owner, and has increased the cost of working considerably.

At different periods efforts have been made to utilize the waste. It has been tried as a road-making material, but was not a success, roads made with slate being very dirty in wet weather. However, there seems to be no reason why it should not be used as a binder in the form of chippings, of which there is a scarcity in the country and for which there is a ready sale at a fair price. It should make a good binder for granite macadam, either tarred or untarred. It has already been tried in brickmaking and is again having a trial as such. A test made some time ago for strength and absorption between a brick made with slate dust and one of the best blue bricks showed the slate brick to be the stronger and exactly equal to the blue brick in absorption of water. Price was the consideration which killed the possibility of making slate bricks before, but at present this should not be the case.

An attempt was also made to find a market for the waste in the form of drain-pipes, and some of the pipes may yet be seen which had as their foundation slate dust. In the manufacture of cement it is claimed slate dust is excellent; and in the slate-quarrying districts a mastic made of slate dust and oil has frequently been used for leaky roofs, the mastic when set being harder than the natural slate.

The endeavor of a North Wales company to work the slate-dust business in the Bethesda district on a large scale is fairly well known in the trade, and its experiment is being watched with interest and copied on a smaller scale by a few. There is a very big demand for slate dust ground to a fine powder, and if it can be so ground at a reasonable cost there is every prospect of the business developing considerably.

An Apple Warehouse of Hay

A SERIOUS shortage of cars, in combination with the biggest apple crop the Pacific Northwest ever had produced, led to an acute situation in Oregon and Washington last fall as the season of frost danger approached. With apples worth well over $2 a box, storage became a very serious problem.

Various makeshifts were resorted to. Church basements were filled with apples, while other church buildings not in use were filled to the roofs. Unoccupied business premises in the apple towns were hired for storing purposes. But perhaps the most interesting device was adopted by a resourceful apple grower at Omak, Washington, who couldn't get cars in which to ship his apples and simply had to devise some kind of efficient storage or suffer a heavy loss.

In his dilemma he remembered that hay has high insulating quality, and that in the baled form it lends itself readily to manipulation. He bought 150 tons of hay, and with it constructed the four walls of a warehouse. On top he put a roof of more prosaic materials. Into this his boxed apples were placed.

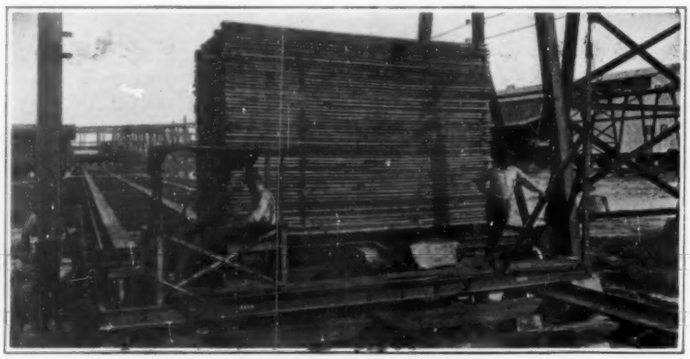
The ingenious apple man declares that his hay warehouse has answered the purpose in every respect.

In the Modern Sawmill

Machines and Methods by Which the Cutting Up of Logs Is Put on a Basis of Extreme Economy

By Harry A. Mount

WHERE is the man who, standing in a great modern sawmill and watching the panorama before him, has not marveled at the ease and facility with which a giant of the forests is converted into the lumber of commerce? There is something genuinely fascinating about the crash and whir of the great saw as it slashes through a mighty tree trunk with unbelievable swiftness. And in the whole lumber industry, not excepting the woodsman himself, there is no more picturesque figure than the head sawyer as he rides back and forth on the log carriage past the whirling saw, controlling this mighty display of power by a movement of his hand.



An electric transfer table with load of lumber

A visitor at a modern mill will not fail to be impressed, too, with the small number of employees required to turn out hundreds of thousands of feet of lumber a day and with the economy that everywhere is evident. It is said that the meat packer finds use for every part of the pig except the squeal. The pig is lucky compared with the log that passes through this mill, for even the sawdust and scraps are burned under the boilers which generate power.

The most surprised visitor of all, no doubt, would be the man who is familiar with the sawmills of ten years ago. The demand for timber has grown apace in the past few years and the lumber industry has made rapid strides in the improvement of its production methods.

In the early days the power employed was that of oxen or horses, or water from a nearby stream. A familiar sight near a lumber mill was a yoke of oxen dragging a load of logs to the saw. Later the ox and horse were superseded by the power of the steam engine. Today the largest and most modern mills of our Pacific slope and in the Southern pine belt, are electrified, and instead of the maze of belts and shafting, a few small wires enclosed in iron pipes, carry the power needed to cut up the big logs. How much this has added to efficiency may be judged from the fact that the electrification of one Southern sawmill recently resulted in a 20 per cent increase in output without the addition of a single machine or employee.

As an example of the amount of power required, one mill on the Pacific Coast which has a capacity of 500,000 feet a day, uses over 350 electric motors totaling in excess of 6,000 horse-power.

Transportation is undoubtedly the most important single factor in lumber production for the lumber must be carried from the lumber camps to the mills, from one machine to another and finally must be carried away from the mill. It is interesting to note that in the case cited above about 75 per cent of the installed capacity in motors is used for purposes of transportation. A trip through this mill will give a general idea of a modern sawmill.

The lumber is floated to the mill from the logging camps, several miles away, by river. The logs are pulled from the water by cables, attached to electric winches and are piled on an unloading dock. As needed in the mill they are rolled into a steel trough, at the bottom of which runs an endless "bull chain." Spaced every few feet are steel hooks or "dogs" which grip the log and carry it along and up an incline into the mill. As the log passes up the incline it goes through a shower bath of high pressure water, shot at it from all sides to remove dirt and stones, which might injure the saws.

At the top of this incline the logs are "kicked" off the conveyor by pneumatic arms and roll on to an incline, down which they slide by gravity into the log carriage. This carriage shuttles back and forth past the "head saw" or main saw and at each trip a big slab of the log is sliced off.

The head saw deserves special attention. Instead of the enormous steel disk that we might expect, we see a huge band saw. The saw blade is about a foot wide and it passes over large wheels, one overhead and the other beneath the floor. Although we cannot see, it is driven from beneath by a great electric motor of 250 horse-power, but there is evidence of resistless power in the businesslike snarl of the saw as it eats its way rapidly through huge logs.

Just in front of the "head saw" is a smaller circular saw, which merely cuts a slot through the bark. It is called the "rock saw" and its function is to dig out imbedded rocks from the bark which might otherwise do serious damage to the expensive head saw. Pipes from a motor-driven blower carry the sawdust away, unseen, to the fuel bin.

As the slab from the log falls off, it alights on a chain of "live rolls" or motor-driven rollers, which carry it away and deliver it to the "edger" where, at the will of the operator, the slab is transferred to the machine by means of trip skids. These skids are raised by a cylinder, the valve of which is operated by an electro-magnet and push button within easy reach of the operator.

The "edger" consists of an arbor on which is mounted two circular saws and as the slab is pushed through these it is sawed to the desired width. The slabs may go, instead, to a "slasher," which consists of an arbor on which any number of saws may be mounted, and upon being forced through them the slab is sawed into any number of boards. The log may be sawed into planks by these machines and these planks sent to the gang saw. This consists of a number of straight saws with a vertical reciprocating and oscillating motion, which split the plank into boards of the desired thickness.

Some of the boards pass through trimmers and others go to a resaw machine to be brought to the proper thickness. A system of live rolls does all the transferring from machine to machine and at strategic points are located "jump" or "swing" saws for cutting the boards to proper lengths.

The lumber all finally comes to a "sorting table," where by a rather complicated arrangement of rolls and chain conveyors, the lumber is sorted. From the sorting table the lumber is taken by transfer cars to automatic stackers, and thence to the dry kilns. From the kilns the lumber goes to the yards, where electric trucks and tractors, transfer cars, and

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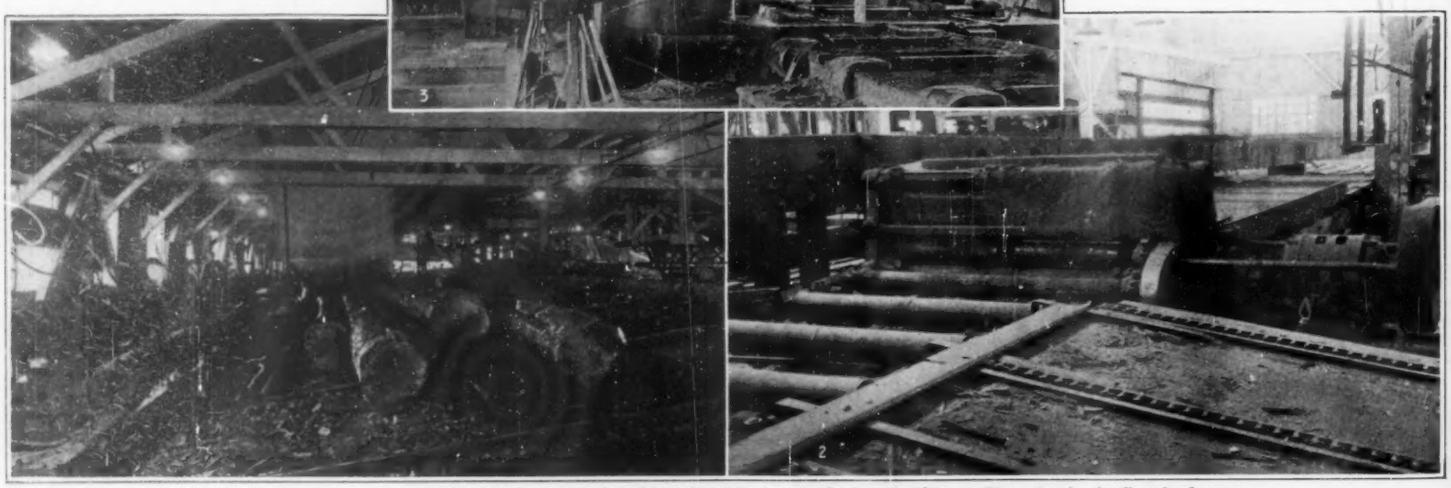
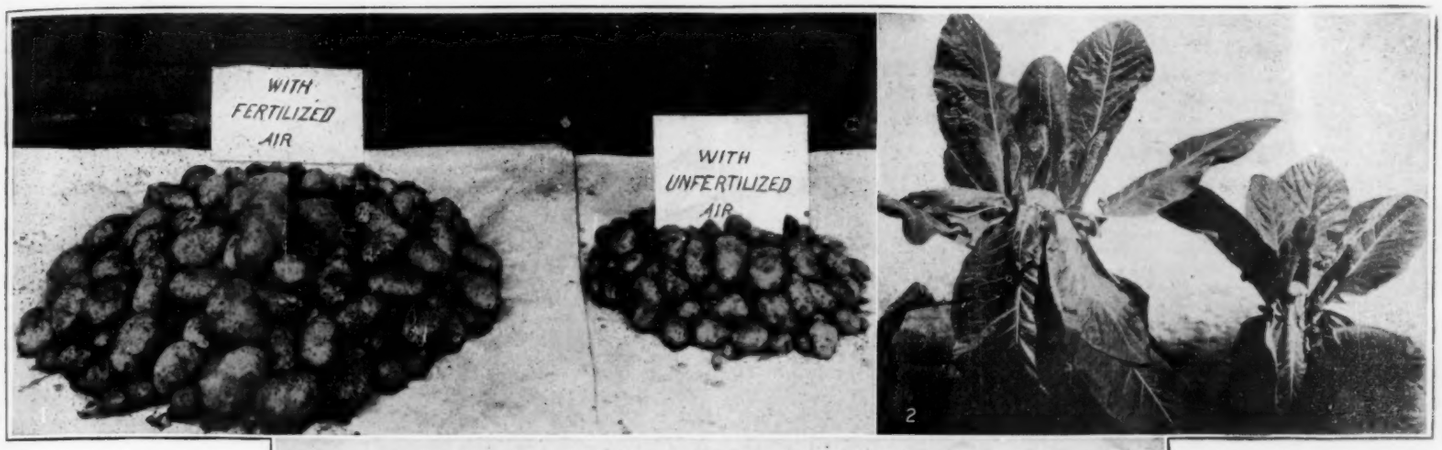


1. Loading logs on the log carriers. 2. The pony edger which trims slabs down to the desired width. 3. Eleven-foot band-mill or head saw.

Some of the big machinery of the modern sawmill



1. Yield of potatoes in fields over which the air was fertilized with carbonic acid gas and left unfertilized. 2. A similar comparison for cauliflower plants. 3. An open-air carbonic-acid fertilizing plant

Fertilizing the air with carbon dioxide to promote plant growth

Carbonic Acid Gas to Fertilize the Air

By Dr. Alfred Gradenwitz

ONE of the principal constituents making up the body of a plant is carbon, representing about one-half of its organic substance. The opinion that this carbon is derived from the soil has long been abandoned, modern investigation having shown atmospheric carbonic acid to be absorbed by means of the chlorophyl or green matter of the leaves and decomposed into its elements, the carbon, in conjunction with the root sap and atmospheric moisture, being worked into organic compounds.

Whereas atmospheric air at present is relatively poor in carbonic acid, of which it contains only about .03 per cent, at an early period in the development of our planet, when this was covered with the luxuriant forests our coal deposits are derived from, it comprised incomparably greater quantities of this gas. This fact suggested the idea of heightening the fertility of the soil by increasing its carbonic acid content and thus producing conditions resembling those of antediluvian ages. In order to enable such a process to be carried out on anything like a commercial line, a cheap source of carbonic acid had, of course, to be provided.

This was found by Dr. Fr. Riedel of Essen-on-Ruhr in the combustion gases escaping from all factories, but most abundantly from blast-furnaces, and which so far had been allowed to flow out into the atmosphere without serving any useful purpose. He accordingly set to work designing a process for which patents were obtained and which was put to practical tests on a large scale. Three greenhouses were at first erected, one of which served as testing room, while the two others were used for checking purposes. The testing room was supplied with purified and burnt blast-furnace exhaust gases through a line of punctured piping traversing the whole greenhouse in a forward and backward direction. The gas supply was started on June 12th, that is to say, at a time when plant growth was at its height.

On account of the careful cleansing and complete elimination of constituents such as sulfur, the gas was found to exert no harmful effects. On the contrary, even a few days after starting the test, there could be observed in the testing room a more luxuriant vegetation than in the checking houses. The leaves of the castor-oil plant in the greenhouse supplied with gas were found to reach more than one meter in span, whereas the largest leaf in the checking houses was only about 58 centimeters in width. Plants submitted to the influence of carbonic acid gas also showed a marked advance with regard to their height. With the tomatoes planted in another part of the greenhouse a crop of 29.5 kilograms was obtained for a given number of fruits, the weight of the same number of fruits in the testing room being 81.3 kilograms, that is, 175 per cent more. With the cucumbers planted at the same time a somewhat slighter difference was noted, the yield in the checking houses being 138 kilograms, in the testing house, however, 235 kilograms, corresponding to an increase in yield of 70 per cent. An interesting phenomenon noted in this connection was that, while the cucumbers in the checking houses would exhibit bright spots, those in the testing house, on account of the more plentiful formation of chlorophyl were of a dark green color throughout.

Experiments in the open air were made simultaneously with these greenhouse tests, a square plot of ground being encircled by punctured cement pipes from which a continuous supply of exhaust gases was escaping. The wind, mostly striking the ground at an angle, would drive the carbonic acid in a variable direction

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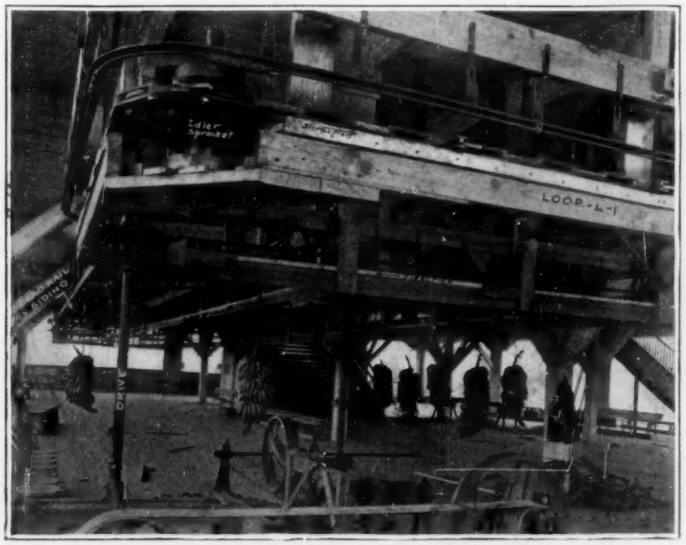


The bananas, hung to trolleys on a monorail, are pushed forward in the desired direction, by fingers attached to the chain shown near the top of this illustration, near L-1. The system is so devised that the over-ripe bananas are given separate and speedier handling. There are monorail sidings, like ordinary railroad sidings, on which the fruit is stored until it can be put aboard a car

A corner of the banana conveyor mechanism installed at New Orleans

Mechanical Stevedore That Handles Bananas

By Thomas Ewing Dabney

A NEW application of an old principle—which is all that invention is—has met the high cost and scarcity of labor on the wharves of New Orleans, and enabled that port to expand its trade in its most important article of import—namely, bananas. This is a handling device which transfers the fruit from shipside to the cars at an estimated saving of 2½ cents a bunch. As New Orleans imports 20,000,000 bunches of bananas a year, this means a gross saving of $500,000. Add to this the saving in time and the fact that there is less damage to the fruit by the mechanical than there is by the physical method of handling, and the annual saving will not greatly miss the million mark.

About 600 shiploads of bananas are brought to New Orleans a year. The average ship carries 35,000 bunches, which are under present conditions unloaded in about seven hours. Three machines of the type shown in the SCIENTIFIC AMERICAN of Oct. 20, 1917, lift the bananas out of the ship and deposit them on the wharf. These machines consist of 50-foot structural towers, with a base 14 by 28 feet, set upon eight wheels resting upon two transverse rails at 14-foot gage. This tower is fitted with a main boom and a plumb marine leg which reaches into the hold of a ship; the bananas are lifted out in a continuous belt of pockets held between two parallel link chains which traverse the marine leg, main boom, auxiliary boom and tower, at the rate of 125 feet a minute. The bananas are finally deposited at the foot of the tower and then lifted upon the back of laborers, who carry them to the car a couple of hundred feet away. But the bus is too fast for the stevedores. Even with 1,000 men working, the greatest number that can be economically employed on the wharves, it is not possible for the machines to work more than 40 minutes in each hour.

To avoid this 33 per cent loss in time—and because of the rapidity with which bananas ripen, especially in the summer, every minute is worth money—William Steckler, an engineer of the Board of Port Commissioners of Louisiana, set his inventive brains in motion. He studied the trolley systems by which meat, auto tires, machinery, etc., are handled in manufacturing plants, and worked out a mechanical means of conveying the bananas from shipside, after they have been delivered on the wharf by the elevator, to the cars.

He has tried it out and it has proven a success. Every banana wharf in New Orleans is to be equipped with the device as soon as it can be manufactured.

The essential features of the device are an overhead monorail of medium design,

(*Continued on page 557*)

With the Engineers of Industry

A Department Devoted to the Physical Problems of the Plant Executive

The Sectional Unit Factory

HOW large is a building? This question, in just this form, sounds trivial enough; but if we translate it into somewhat different terms, and ask, with the executive, "How large a building will this department require, and how large a building can be erected for it in the time and with the funds available?" it takes on an aspect of real importance. One of the most embarrassing situations in all industry revolves about this problem of factory housing. And the statement that a new type of factory construction has been developed that automatically solves the problem before it arises is of interest to every growing business.

The principle employed is that of the sectional bookcase. We all remember what a task it was to house a growing library in the old days of the rigid bookcase, and what a boon we found in the bookcase that grows with the books, and is always just the right size to hold the volumes which we have to put in it. From the designer's viewpoint, there was little to the sectional bookcase save the idea. When that idea is taken over by the manufacturer of building materials, however, the idea becomes the least perplexing detail, and a great deal of careful thought must be devoted to the working out of styles and sizes of the building units, and to the means of joining them up.

The manufacturer who features this style of construction in his catalog uses pressed steel as his basic material. The design of each part has been carefully studied in order to develop maximum strength from minimum material, and of course maximum standardization. The wall unit, furnishing the starting point, is made in various heights, and is interchangeable with door units; it is furnished with and without window frames, so that by appropriate alternation any desired arrangement of blank wall or window space can be obtained. Every field joint and connection is made weather-tight and element-proof. Through the use of a simple and practical device which makes all field connections, the buildings are erected speedily and at a low labor cost. Since they can be taken down and re-erected without replacement of any part, they have a salvage value of one hundred per cent. The removal of one of these buildings, in fact, is a process entirely analogous to the taking down of a sectional bookcase on moving day and its re-assembling in the new apartment.

The length and width of the building may be carried to any desired extreme

(*Continued on page 558*)

The Question of Reflecting Surfaces

OF fifty-eight large steamship piers which have been inspected, 42.6 per cent had illumination which was entirely inadequate and generally poor, 51.2 per cent had fair illumination and only 6.2 per cent had good illumination. The average watts per square foot of these electrically lighted piers was 0.16, varying from a minimum of 0.05 watt to a maximum of 0.34 watt. Very much better illumination results would have been obtained in nearly every case had the equipment been well maintained and the surroundings occasionally painted with white or other light paint. Only 3.6 per cent of the piers had white walls and ceilings; 9.1 per cent light-colored surroundings, 20 per cent medium-colored, 52.8 per cent dark, and 14.5 per cent very dark, almost black, according to A. L. Powell (Lighting Service Department of the Edison Lamp Works of the General Electric Company), an authority on illumination.

The results of the better conditions in those piers having well-maintained fixtures, light surroundings and adequate illumination were (a) greater actual speed of trucking, (b) markings more easily read, (c) fewer missent shipments, (d) spoilage and theft reduced, and (e) relations with the public greatly improved.

Of course, this particular survey deals with piers, but is it any different in the average factory? Black or dark walls mean the absorption of useful light which might otherwise be turned to some real work. There are many suitable paints on the market with highly reflective qualities which serve to distribute both daylight and artificial light into every corner of a large plant. There are numerous styles of fixtures which make for the maximum illuminating efficiency. But all these are of little use if permitted to discolor or become heavily coated with dust, since their efficiency is reduced in direct proportion to their departure from absolute cleanliness.

The Matter of Steam Pipe Insulation

NO engineer would think of using bare wires for carrying heavy electric currents; he would insist on their insulation. Yet there are cases almost without end where plants which are held up as models of efficiency, use steam pipes that are not insulated in the proper manner. And just as electric current would leak in the instance of uninsulated wires, so do heat and steam leak or become weaker when carried through uninsulated pipes.

There is no excuse for uninsulated steam pipes at this time when, on the one hand, coal is selling at exceptionally high prices, and when, on the other hand, fuel engineers have made such a thorough study of heat insulation. Two symptoms, we are told by heat insulation engineers, always signal heat loss from a steam pipe. One is lowered pressure in the pipe, the other is high temperature of the air surrounding the bare or poorly insulated pipe. Obviously, this falling pressure or surrounding heat means that fuel in the form of heat is being wasted. Pipe insulation is necessary.

An insulation to be of maximum value must have more than the property of preventing heat loss. It must also have physical durability, for a short-life material means early replacement, so that if insulation values are equal, the most durable insulation is the most economical. A number of heat insulating materials are now on the market, and companies producing these materials have a staff of engineers who specialize in problems of this kind. Both indoor and outdoor installations, overhead and underground, and every other condition can be met by consulting the heat-insulating engineers.

Spraying Paint for the Sake of Morale

AS someone has aptly put it, what a big difference the proper application of a little paint makes. Light, cheery, sanitary and thoroughly protected factory walls and ceilings benefit both plant owner and his men to an immeasurable extent. That is a different angle to the paint problem already covered in another item in this department.

But the accompanying big paint and labor bills, where costly, deficient painting methods are employed, are out of all proportion to the benefits derived. Again, in most plants the paint does not remain clean and fresh for any length of time, hence painting must be done at regular intervals.

Just here is where spray comes into its own. Any one of the several types of portable painting equipments now available makes possible four or five times faster work than can be done with the old-style paint brush. All coats are applied more thoroughly and uniformly on every part of the surface, insuring a longer wearing and greater light reflecting surface. The need of scaffolding is saved in many places. The men are enabled to work with less fatigue and to leave the surroundings in cleaner condition. The outside and inside work is done equally well with any kind of paint, requiring no more than when brushing. But why go on? The spray method of painting is unquestionably a vast improvement over hand method for such work as we have been discussing.

A Rival of the Steam Whistle

IT may be that the steam whistle in time will be a matter of past history; at least, the steam whistle is steadily losing ground in favor of the electric siren, which has proved considerably more efficient in more ways than one.

In industries large and small, in mines, factories, foundries—wherever a warning signal with greater range and more distinction in tone than the steam whistle is required—the electric siren has been found to fill a long felt need. The electric siren is clear, unmistakable, most distinctive. It cannot be confused with any other sound. While a boiler full of steam is needed for the steam whistle, the electric siren may be operated from any number of places through the factory by a simple turn of the switch. It is always ready, dependable, fool-proof, insignificant in upkeep cost. The electric siren can be either large or small—large enough for the largest works, and small enough for use in any department of such works, where it must signal through the noise and din of incessant toil and bustling activity.

A New Idea in Factory Heating

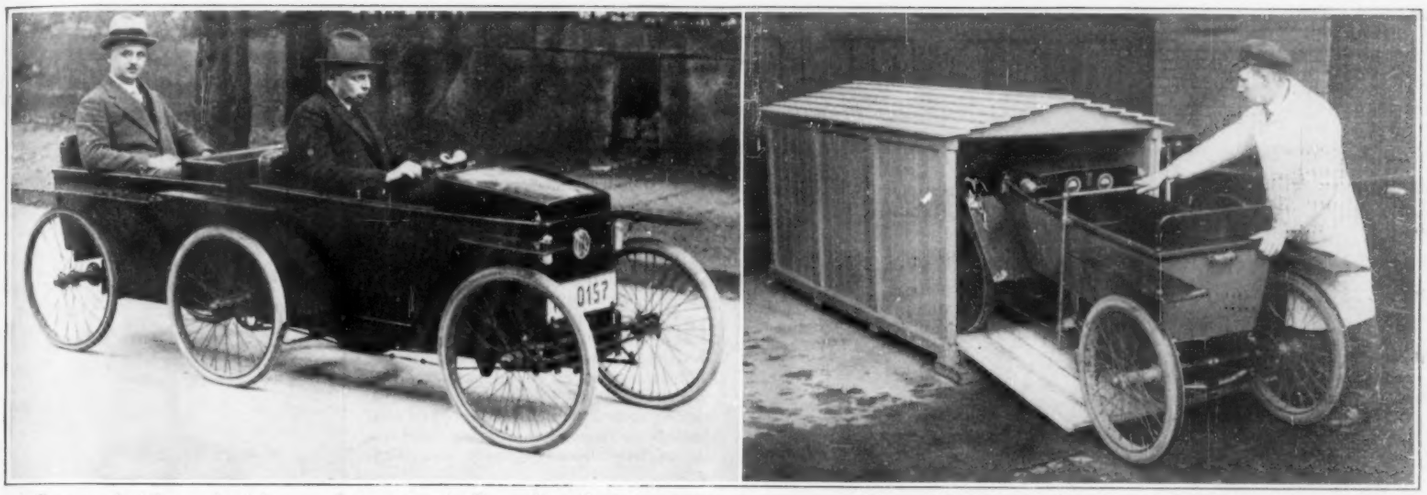
THE very expansiveness of the average plant often renders the usual systems of heating somewhat faulty and inadequate. The heat is not distributed through the large bays, because there is no way of getting it into circulation.

With a view to getting heat to every part of the largest factory bay, one concern has developed a heating system which is claimed to heat the factory to the same comfortable, uniform degree. No matter what the weather conditions, type of building, construction, size of space to be heated, and other factors, the new heating system is said to heat all of the open space, so that remote, far-off corners will be equally as warm as the area immediately surrounding the heater.

To get down to specific details, the heater is a compact, self-contained unit which requires no pipes or ducts for air distribution. Installation cost is 15 to 50 per cent less than other types and

(*Continued on page 558*)

Sectional factory buildings of pressed steel units, one in course of construction to show the framework, the other completed to make clear the general style. In the latter, the individual units can be easily identified, and give some idea of the flexibility of this construction



A German electric runabout for one, that sports a trailer making the transport of a passenger possible, and that occupies less space in the back yard than some dogs

The Electric "Klein-Automobil"

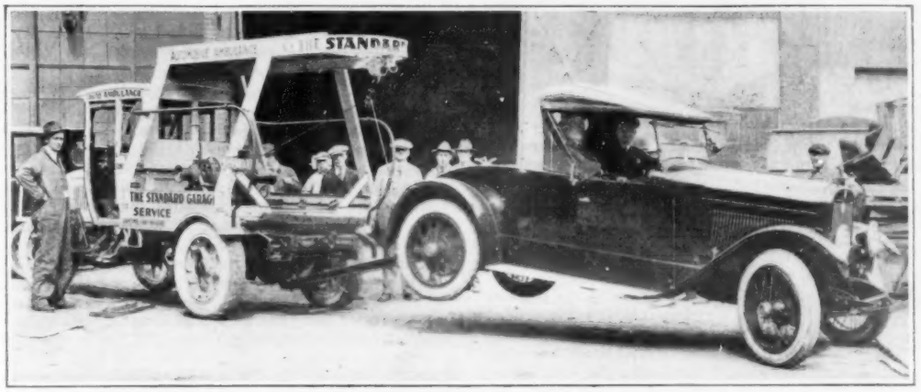
ON a recent motor trip between New York and Delaware Water Gap, we pronounced the main street of the largest town between Morristown and the Delaware to be the worst bit of road we had ever met; and we have heard of cars wrecked by the rough going on the Liberty Highway between New York and New Brunswick. When such things as this are possible, it is evident that the "small car" of song and story is the smallest and lightest vehicle that we can hope to employ on American roads for many years.

In Europe, on the other hand, road conditions are very different. There are literally thousands of miles of highway, fairly honeycombing Britain and the western part of the Continent, on which anything heavy enough to give itself traction will ride with speed and smoothness. Hence there is a large field for something that shall really be a little below the class of the true automobile—something that shall weigh a fraction of a ton only and make anywhere from 60 miles upward on a gallon of fuel. The existence of this field is daily attested by evidence both of production of such vehicles and of demand for them.

It now appears that the manufacture of these little runabouts is not to be confined to the gasoline system of propulsion. One of these tiny baskets on wheels, now being marketed by a German company, derives its power from batteries. The car is made in one model only, a one-passenger runabout, with wheel-base 57.12 and tread 33.45 inches. The weight is 440 pounds, which makes the suggestion of our picture, that the proprietor is picking his car up and tucking it away in its minute garage, not quite so absurd after all. To it can be attached the two-wheeled trailer for an additional passenger shown in our other view; or for this may be substituted an auxiliary of different style for delivery purposes.

Electric current is furnished by two 24-volt lead-plate batteries of 6 cells each, located in the forward part of the car. These require 2½ kilowatt hours for a full charge, which will drive the car about 35 miles in Berlin, where the streets are well paved and have fewer grades than in the average city. The electric motor develops about 1½ horse-power and permits a maximum speed of approximately 13 miles an hour. The motor is set well back in the frame, very close to the rear axle. The power is transmitted by a chain to a jack shaft set forward of the motor, and thence by a single chain to the right rear wheel. This use of a single driving wheel obviates the necessity of a differential.

The car is quoted at 13,000-14,000 marks and the trailer at about 4,000 marks. If it is not wholly clear that these are one-cent marks of the vintage of 1920, the quotation of 2,550 marks for a reserve battery ought to make it plain that this is the case, and that anyone who is in a position to apply real money to the purchase of this vehicle will get it very cheap. We are informed that the company has a present capacity of 100 cars per month, and that already 300 of the vehicles have been delivered and put into use.



If the damaged car can be salvaged, this wrecking outfit will do the trick

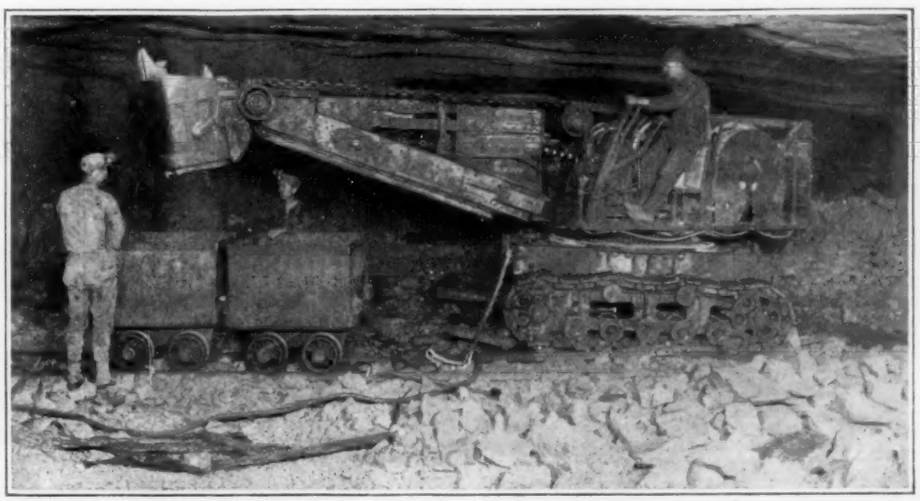
First Aid For the Crippled Car

WE illustrate an admirable automobile ambulance which is in service at a Toledo garage, and which is of such evident all-around utility that it is difficult to imagine any case of a sick car which it could not treat — barring, of course, that the patient were totally defunct. The designation "automobile ambulance" is one given the new outfit on the basis of its performance, and one which it readily can be seen to deserve. Not at all cumbersome itself—its foundation is a 1½-ton chassis—it is able, with one man at the winch, to lift easily cars weighing in the neighborhood of five tons. Another feature of material value is the ability to pick up a car from the rear without damage to fenders, tank or body. This has always been difficult when a rear wheel or axle was damaged and the crippled car had to be moved to shelter.

A Lilliputian Mining Machine

WHEN labor costs at a Missouri lead mine reached a point that made it necessary to consider the designing of a machine that would combine the digging and loading functions and that would not exceed 7½ feet clearance, it might have been supposed that this problem had no solution. A Lorain, Ohio, company undertook the construction of such a machine, however.

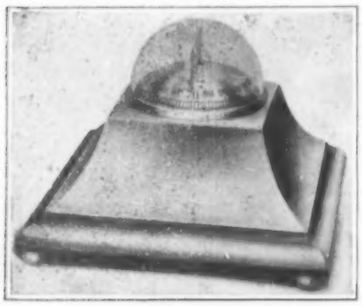
The machine consists of a rotating turntable which carries all the mechanism, and upon which is mounted the boom structure. The whole is carried by a truck frame operating on caterpillar treads. The machine is capable of digging and loading at any point in the circle. It is self-propelled and power-steered, so that it can be readily moved about in the mine. Provision is made at the point of the boom for raising the boom sheaves in the event that excess dumping height is required. The performance of this machine shows a cost per ton of material delivered to the shaft that runs from 5 to 20 cents, as against a previous cost with hand labor of 25 to 60 cents. Its normal operating speed is three digger loads per minute, with a crew of two or at most three men.



A mining machine that digs and loads in a drift into which ordinary apparatus could not go

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts



A small flag swings around to indicate the temperature in this office desk thermometer

When a Small Flag Tells the Temperature

THE small flag mounted in the center of the office desk thermometer, shown in the accompanying illustration, swings around at the slightest breath and tells the temperature. The raised dial around which the flag travels is graduated like the face of a watch. So sensitive is the device that the slightest draught will send it on its way indicating the change. Not much thought has ever been given to the average temperature indicator, but in this recently patented design beauty has been added to accuracy, making an ideal combination.

Finding the Small Breaks and Cuts in Tires

TIRE repair men do not depend upon their hands and eyes in the inspection of tire tubes with a new machine shown in the accompanying illustration. It opens and inspects the stiffest tire in ten minutes. The entire surface of any sized casing may be readily seen. It is then inspected thoroughly under a powerful concentrated light. All the small breaks and cuts which are generally at the bottom of much tire trouble may be found easily. It tells the unvarnished truth about your tire, so to speak.

The inspection of tires becomes a simple and positive job with this machine

A Pocket-Sized Electric Blasting Machine

WITH the blasting machine shown in the accompanying illustration, all that is necessary to fire the charge is to turn the key at the bottom of the electric blaster as far to the right as it will go. One turn is sufficient; and the key can be removed and carried in the pocket of the man in charge of the blasting, insuring absolute safety. The leading wires are connected to the binding posts of the blaster. It is light in weight and can be carried about easily.

It should be obvious that this little blaster is only intended for the firing of a few charges at a time. In fact, it has been developed by a powder company for the use of farmers and small contractors whose modest needs would make a large blaster a luxury, so to speak.

One twist of the handle serves to operate the small electric blasting machine

Packing of Dyes, in Powder Form, for Dispatch to Foreign Countries

THE following regulations have been issued by the United States Post Office Department regarding the packing of dyes, in powder form, for shipment to foreign countries:

Dyes, in powder form, must not be accepted for transmission in the parcel post mails to those foreign countries admitting dyes in the parcel-post mails, except those dyes packed in a tin or metal container and such container inclosed in a substantial outside cover, open to inspection, of fiber board or similar material, double-faced corrugated cardboard, or strapped wooden boxes made of material at least a half inch thick.

The inside tin or metal container must be one closed with a screw-top cover having sufficient screw threads to require at least one and one-half complete turns before the cover will come off, the cover of which must be provided with a washer, so as to prevent possible sifting of the contents.

This provision for the employment of screw-top tin or metal containers does not prevent the use of compression (friction) tin top or metal containers, if soldered in at least four places, or the use of lead-sealed tin or metal containers, provided the containers are labeled in printing so as to show the nature of the contents, the quantity, and the name of the manufacturer or dealer, and, in addition, the containers are inclosed in substantial outside covers, open to inspection, of fiber board or similar material, double-faced corrugated cardboard, or strapped wooden boxes made of material at least a half inch thick.

Acceptable packages of samples of dyes, in powder form, not exceeding 12 ounces in weight, and packed in accordance with the requirements of the Postal Union regulations, will likewise be received for transmission in the international parcel-post service, when postage is paid at the rate of 12 cents a pound or fraction thereof.

Still Another Scheme for Harnessing the Wind

EUROPE is facing a serious shortage of fuel of all kinds. Coal, gasoline, wood, alcohol—all these common forms of fuel are lacking. In consequence the inventors of numerous countries have turned their attention to the power and heating problem, and many strange things have been suggested and tried out.

Among the many new ideas is the vertical wind mill shown in the accompanying illustration. This is a French invention, and it is reported to be quite satisfactory where the prevailing winds are more or less constant throughout the year. Among the advantages claimed for this form of vertical windmill or wind turbine are: Power no matter in which direction the wind is blowing; noiseless operation; the windmill does not have to turn about to face the wind, hence no loss of time; no danger of damage from strong winds or gales; five times the power derived from the usual forms of windmills; no mechanical upkeep or operating expense. The inventor is ready to undertake the building of such windmills in all capacities from ½ to 100 horse-power and over.

In order to take care of fluctuating winds, the windmill is employed in connection with an electric generator and storage battery. In this manner the mechanical power is converted into electricity and stored away until required. However, the inventor assures us that the windmill operates in practically any weather, and that only a few days are really lost throughout the year.

The hot glass dish may be readily and safely handled in a wire frame

An Ounce of Wire Prevention

IT has not been long since glass was first introduced in which to make pies and other tempting dishes for the table. Our grandmothers, a few years ago, would hardly think such a thing possible— to bake in glass in place of tinned or enameled iron and crockery.

However, glass is coming into such general use that a manufacturer of wire novelties has conceived the idea of making wire frames into which these glass accessories of the kitchen may be placed while in the oven. The ounce of prevention is this. Hot glass dishes are hard to handle. Frequently when they are brought from a hot oven and placed upon a cold surface, they will crack. With the new wire frames both of these objections have been overcome.

As we have often pointed out in these columns, it is such inventions as this one which meet with a ready market. Indeed, there is a tendency to overlook the simple things in inventing; yet it is the simple things that usually take best.

Copyright Keystone View Co.

This French windmill may be built for any power from ½ to 100 horsepower, depending on the size

Could Anything be Simpler than This Lamp Bowl?

IT is certainly uncomfortable for the eyes to work before an unshaded incandescent lamp. Eye fatigue results, and if the practice is continued for long periods of time, the fatigue must necessarily extend to other parts of the body. At any rate those who make a special study of shop accidents tell us that fatigue causes men to become careless, and that most of the accidents occur between the hours of three and four.

Improper lighting is the greatest cause of eye fatigue, and despite the many advances made in improving working conditions in our shops and factories, one often finds no provisions for safe-guarding the eyesight of the workers. Reflectors cost money, to be sure, and their installation is often overlooked because of the expense and trouble involved. But the invention of a simple reflector and holder, recently placed on the market, removes the objections of trouble and expense. Indeed, so simple is the combination of the wire holder member and the translucent bowl that there is no excuse for failing to shield incandescent lamps in this manner. The shade or bowl may be snapped on or off for cleaning purposes, and the holder fits any incandescent lamp.

Any incandescent lamp can be instantly fitted with the simple holder and bowl

Making the Barge Canal Pay

(*Continued from page 542*)

Lake Champlain Transportation Company has 24 barges, the Murray Transportation Company has 26 barges and the Transmarine Corporation has several fleets of steel carriers in operation on the waterway. There are, in addition to these, 500 boats of the old Erie Canal type owned or under charter to industries while many corporations have from 1 to 20 barges of special design in constant operation. These latter operators include the General Electric Company, American Radiator Company, Standard Oil Company and a number of cement companies.

Some of the corporations appear to have set out to use the canal to the limit of their needs. The channel had no sooner been opened last spring than the Standard Oil barges were on their way up the canal. This company brings oil to Albany in large tank steamers and pumps the fluid into storage tanks. From these tanks the oil is pumped into the canal tankers and shipped as far north as Burlington, Vermont, and as far west as Rochester. The company has stations at nearly every point of any size on the canal and, at several places where the Standard Oil has both rail and water connections, not one carload of oil was brought in by rail during the past navigation season. Some idea as to the extent to which the Standard Oil Company is using the State's waterway may be obtained when one is told that it has expended $110,000 in constructing a turning basin at Rochester. This clearly demonstrates that this big corporation, with its array of engineers, statisticians and economists, thinks that New York's Barge Canal is a going proposition and it certainly shows that the channel is a structural success.

The General Electric Company is also shipping a great deal of its finished products from its Schenectady plant to New York over the canal. This company reports that it can bring its water shipments from Schenectady to New York in the time it takes the railroads to get a car out of the company's yards and plans have been prepared which call for the construction of a private terminal at Schenectady to handle the General Electric shipments.

Despite this and other evidence that many shippers have found that shipping by canal is a paying proposition, there is still much ignorance among shippers relative to the waterway. A Buffalo manufacturer was recently complaining that he could not get his steel products to New York City. He said that the rail lines positively could not get the goods through. He was asked why he did not ship by canal and was surprised and startled to learn that there was such a route available. This is only one instance, but it shows the need of acquainting people with the availability of the Barge Canal.

The trouble is that almost a generation of men has grown up which thinks of transportation in terms of rail shipments only. This should be changed, and if it is done these shippers will think in terms of water routes as well as rail lines. If they once begin to think this way they will find that it is greatly to their advantage to utilize the canal system. What is required to bring this home to them is a "Ship by the Barge Canal" movement and this should not be limited to the State of New York but should cover the Great Lakes, New England and Middle Western States as well.

Shippers and industry demand relief from freight congestion. Because of the present lack of carriers, many have been disappointed in their search for cargo space in canal carriers. The Great Lakes shipper demands that his grain and other commodities be moved to the ocean at the cheapest possible rate and by the shortest route. He knows that recent increases in railroad freight rates, according to his schedule of costs, have placed him just 500 miles farther away from the seaboard than he was in 1918. In other words it now costs him as much to move his freight to New York as it would have cost him to have shipped it 500 miles beyond that port in 1918. He must have relief and the Barge Canal will afford him that if he will use it; for, now that capital knows that Federal operation of barge fleets will shortly be a thing of the past, it is constructing barge fleets and many responsible carrying corporations are being formed which will not only be in a position to approach the shipper and offer him cargo space but will also present him some workable plan whereby he will be guaranteed that his cargo will reach its destination within a stipulated time. In fact, one carrying corporation now moves its fleets on a set schedule and is extending its facilities by constructing its own terminals at Buffalo and Newark, New Jersey.

The reawakened interest in waterway matters does not rest here, for merchant marine interests, aware of the facilities the canal system affords, have become interested in the channel. This has been demonstrated by the movement recently launched by a prominent group of marine men who will shortly establish a waterway association that will give shippers and canal adherents, in general, a direct service. This organization plans to bring about coöperation between shippers, Great Lakes carriers, barge lines and vessels in the American Merchant Marine. It seeks to obtain low rates on goods which are to be exported and will, through coördination, enable the shipper in inland cities to bill his goods direct to Liverpool or other foreign ports via the Barge Canal.

In the steel trade, rail freight rates from Buffalo to New York amounted to $3.90 a ton in 1919 while the canal rate was $2.50 a ton or a differential in favor of the waterway of $1.40. Authorities believe that with proper organization steel can be shipped between Buffalo and New York for $2 a ton and, in fact, the Transmarine Corporation is offering to handle steel products to Bridgeport, Conn., at a rate of $2 a ton. With rail rates 40 per cent higher this year than they were in 1919 and using the suggested figure of $2 as a basis, the canal differential on steel would be more than 50 per cent. The same condition is true of iron ore and other commodities.

The original Erie Canal was constructed before the advent ot the railroads and for over fifty years it was the cheapest medium for transporting freight. With the development of the railways, however, the canal gradually lost its advantages so, in order to hold its position various enlargements were undertaken. These conditions lasted for a time but not for long, as the railroads were also improving their efficiency and lowering their rates. The explanation for this is easy to discover, as the cost of transportation is made up of two items, namely, a carrying and a terminal charge and, though the canal could move freight cheaper than the rail lines it had no public terminals, whereas the railroads had these aids. This placed our early canal at a great disadvantage and was the chief cause for its decline.

The construction of the Barge Canal, with its terminals, waterhouses and multitude of freight-handling machinery has wiped out the disadvantages of the old route and has, in addition, provided a means for handling freight at a cost which is less than that asked by the railroads. The rail lines have not been able to cut down their terminal charges to the same extent that they have their carrying charges, due largely to the fact that they have been more interested in transporting freight than in reducing the total cost of handling it.

The last Legislature appropriated funds to start the construction of State-owned grain elevators at Oswego and on the

(*Continued on page 555*)

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Apparel

GARMENT PROTECTOR.—K. HEITLER, 605 W. 141st St., New York, N. Y. The invention relates to the construction of a sanitary garment which encircles the limbs and abdomen of the wearer; the device is equally applicable to infants or grown persons of the female sex; it will permit a sufficient quantity of air to come in contact with the parts enveloped and permit the evaporation of perspiration although preventing the escape of any fluids.

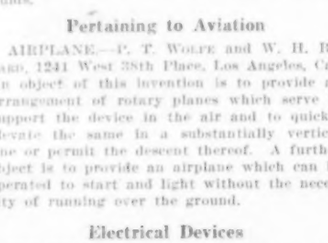
Pertaining to Aviation

AIRPLANE.—P. T. WOLFE and W. H. BOYARD, 1241 West 38th Place, Los Angeles, Cal. An object of this invention is to provide an arrangement of rotary planes which serve to support the device in the air and to quickly elevate the same in a substantially vertical line or permit the descent thereof. A further object is to provide an airplane which can be operated to start and light without the necessity of running over the ground.

Electrical Devices

ELECTRIC SWITCH.—H. F. IRRGANG, Box 72 St. Marlies, Idaho. The primary object of the invention is to provide a mounting for switch handles, which embody a movable bridge piece, which will completely safeguard the person manipulating the same against contacting with any of the charged parts of the switch in moving the bridge piece to break or make the circuit.

ELECTRODE HOLDER.—W. E. CLEMENTS, Oroville, Cal. The invention relates more particularly to electrode holders designed for electric welding, an object being to provide a construction of fork consisting of two spring



AN ELEVATION AND LONGITUDINAL SECTION OF THE DEVICE

members adapted to grip an electrode between them, these members being so shaped transversely as to give a three-point contact engagement with the electrode, thereby securely holding it but permitting of any desired angle in accordance with the operation to be performed.

WIND WHEEL ELECTRIC GENERATOR.—A. H. HEYROTH, Geraldine, Mont. The object of this invention is to simplify the construction and operation of generators of the character referred to so as to be more reliable and efficient in use, economical to manufacture, and so designed as to be used in combination with a rectifier, whereby continuous current can be obtained for the charging of storage batteries and other purposes.

Of Interest to Farmers

FARM IMPLEMENT.—D. D. SOMMERS, Box 161, Champion Alberta, Canada. The principal object of this invention is to provide a bar which trails along beneath the surface of the ground for destroying weeds and heavy grass, either by pulling the weeds or grass up by the roots and leaving them on the top to dry, or by bending them flat with the top of the ground and covering them with earth to such a depth that they will decay.

SCARIFIER ATTACHMENT FOR ROAD GRADERS.—J. A. WILLIAMS, Box 152, Aurora, Mo. A purpose of the invention is the provision of a scarifier of simple and efficient construction having teeth of a form to permit additional metal being welded thereon when they become worn or broken, thereby eliminating any waste of the metal. The device is provided with means for attaching it to any standard form of road grader.

STEERING MEANS FOR TRACTORS AND OTHER VEHICLES.—R. TINKER, Box 292, Monmouth, Ill. This invention has particular reference to the steering of tractors where two frames are pivoted together on a vertical axes, the adjacent corners of the coupled frames being drawn together on either side as desired, which causes a lateral movement of the coupled frames one relative to the other for steering purposes.

Of General Interest

SAMPLE CARD.—A. WEINBACH, 696 Howard Ave., Brooklyn, N. Y. The object of the invention is to provide sample cards for displaying samples of woven fabric and more particularly relates to cards on which the samples are carried by tabs detachably secured to the card, whereby a card formed of a single sheet of material is adapted to receive samples on both sides, the securing tongues being protected and concealed.

COLLAR BAR.—A. BROWN, c/o M. J. Graner Co., 334 5th Ave., New York, N. Y. The invention relates to collar bars for use at the front of a soft collar for retaining the adjacent ends in position, and more particularly relates to collar bars of the type presenting clamps at the ends between the members of which the opposed lateral edge portions of the collar are adapted to receive the clamp for making a neat fastening.

FISHLINE ATTACHMENT.—M. J. CROSBIE, 152 West St., New York, N. Y. The patentee provides a useful device easily applied to a fishline at any desired point for attacking the snell. The form of the device maintains the baited hook away from the line to afford an attractive lure and prevent tangling of the snell with or without the fish. The device can be conveniently applied and should prove especially useful for deep-sea fishing.

SECTIONAL SCAFFOLD.—J. J. MACKLEM, Goshen, Ind. This invention has reference more particularly to a sectional structure with bracing and locking adjuncts whereby the whole may be readily assembled and disassembled. The primary object is to provide a ladder scaffold which will be simple in construction, strong and efficient in use, and readily adapted to various conditions and locations.

COLOR INDICATING CHART.—J. F. KAUFMAN, 883 7th Ave., New York, N. Y. Among the principal objects of the invention are to quickly ascertain the colors which harmonize by contrast or by combination to vary the harmonizing colors correspondingly, to register the colors employed for identification, to shade and tint, key and coördinate colors correspondingly, and to mechanically ascertain from a given key any of the color harmonies desired.

ALLOY.—F. MILLIKEN, 55 John St., New York, N. Y. The object of the invention is to provide an alloy more especially designed for use in mine water valves and other devices subjected to weak acids. The alloy consists of the following metals in approximately the proportions specified: Copper 42-52 per cent, nickel 22-28 per cent, lead 22-30 per cent.

GYROSCOPIC TOP.—K. EDISON, c/o Harry E. Block, Spring Valley, N. Y. Among the aims of the invention is to construct a gyroscopic top which may be operated entirely independent of any cord in that it combines as an essential part of its mechanism an operating means for a gyroscopic wheel, and further, the invention combines a structure which will cause a continuance of the stabilizing feature even after a cessation of the rotation on the part of the wheel.

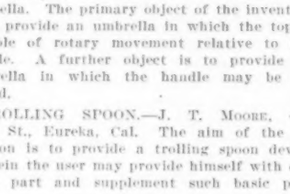
PASS BOOK.—T. P. MARTIN, JR., c/o Oklahoma Stock Yards National Bank, Oklahoma, Okla. This invention relates more particularly to a pass book construction which embodies a detachable inner pad in order to allow of renewal from time to time, the prime object being the provision of a cover permitting of ready use of the ordinary pass book pad in such manner as to show the depositor's name through a window in the cover.

BOTTLE CLOSURE.—C. E. BLANCHARD, 3811 Cottage Grove Ave., Chicago, Ill. An object of the invention is to provide an inexpensive bottle closure which may be secured to a bottle container liquid and which will substantially prevent the refilling of the bottle without detection. A further object is to provide a closure which hermetically seals the bottle, it being only necessary to cut off a portion of the closure to permit the pouring out of the contents of the bottle.

REVERSIBLE CHAIR.—F. S. PASCOE, Cristobal, Canal Zone, Panama. The invention relates particularly to a chair designed for use by a small child, an object being to provide a device which is reversible, so that when it is in one position it functions as a small rocking chair and when in the inverted position functions as an auxiliary seat for an ordinary dining chair to provide in effect, a high chair.

UMBRELLA.—R. ESTURO, 213 E. 80th St., New York, N. Y. This invention pertains more particularly to the handle structure of an umbrella. The primary object of the invention is to provide an umbrella in which the top is capable of rotary movement relative to the handle. A further object is to provide an umbrella in which the handle may be removed.

TROLLING SPOON.—J. T. MOORE, 407 East St., Eureka, Cal. The aim of the invention is to provide a trolling spoon device wherein the user may provide himself with one basic part and supplement such basic part



A PERSPECTIVE VIEW OF THE DEVICE

with different spoons, decoys and hooks, which are detachably secured to said part, thus saving a sportsman expense in outfitting himself for the catching of various fish. The substituting of one form of hook for another may be effected just as readily as the disengagement of the spoon.

RECEPTACLE CLOSURE.—D. BLOOM, 1526 McGee Ave., Berkeley, Cal. The aim of this invention is to provide a receptacle closure which will produce an absolutely air-tight closure. A further object is to so construct the device that it may be readily sealed by any one without the practice of any degree of skill, and although sealed in such a manner as to be air-tight, may be opened instantly. The closure may, after the opening of the receptacle, be used as a lid.

TABLE IMPLEMENT. — E. DE TEIXEIRA, Setauket, L. I., N. Y. Among the principal objects which the invention has in view are to provide a single implement for numerous uses, to meet the several demands for the preparation of food for personal consumption, to economize the transportation space, and to avoid loss of implements. The implement includes a table fork with cutting edge, spoon, corkscrew, nut cracker, can opener, cutting blade and a wedge-shaped end for cutting ice or similar service.

MILK CAN HANDLE.—P LAMBRAKOS, 206 E. 59th St., New York, N. Y. The invention relates to handle attachments, and more particularly to a handle device for clamping upon cylindrical bodies such as milk cans and the like to facilitate the handling and transportation of the milk cans. It is an object to provide a handle attachment having a rotatable element rigidly mounted on a frame, the whole of which may be quickly and conveniently attached to the can.

WINDOW SEAT.—L. VIEZZI, 435 W. 7th St., West New York, N. J. The object of the invention is to provide a seat for the accommodation of a person employed in washing, or doing other work outside a window; the device is arranged to permit of being conveniently and quickly attached to the window sill, and projecting sufficiently far out to enable the occupant to readily wash the window or do other work without danger of losing their balance and falling.

HAIR WAVER.—H. NATKIEL and I. FREEDMAN, 218 E. 122nd St., New York, N. Y. The invention relates to ladies' toilet articles. Among the objects is to provide a simple and easily manipulated device for curling or waiving hair. The device comprises two outer reversely bent bow-shaped bars rigidly connected at one end, and a third bar located between the first two mentioned, the third bar having a sinuous form upon which the hair is adapted to be wound, the ends of the bars being provided with a locking hook.

SPOOL.—B. N. KNOCHE, 219 Grand Ave., Baldwin, L. I., N. Y. The object of this invention is to provide an exceedingly light thread carrying spool. Another object is to provide a spool made from a single piece of material such as wood, wood pulp and the like, which is strong, and arranged to properly fit the spindle of the machine on which the spool is to be used.

TELESCOPE.—M. LICHTMAN, 172 E. 93rd St., New York, N. Y. This invention relates to telescopes, and more particularly to means for securing an eye piece and object glass to the telescope, and also a catch which is adapted to secure the barrels of the telescope in a plurality of positions. An object is to provide a telescope which is simple in construction so that it may be manufactured at a low cost.

Hardware and Tools

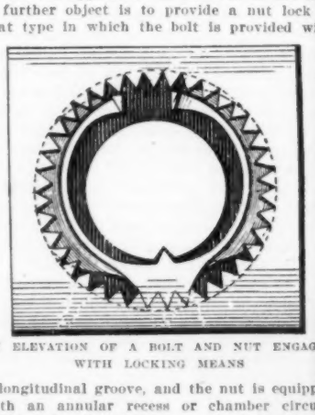
PIPE WRENCH.—A. W. KIEFER, 1909 N. Keystone Ave., Chicago, Ill. Among the objects of the invention is to provide a pipe wrench which can be quickly adjusted under working conditions to firmly hold objects of varying size, to provide a device in which the gripping members will hold more firmly when a positive turning force is applied, and in which any worn or broken parts may be replaced at small cost.

SCRIBER.—L. VIEZZI, 435 W. 7th St., West New York, N. J. This invention has for its object to provide a scriber for use on squares and similar drafting tools such as are generally used by carpenters and other persons and arranged to enable the user to accurately set the scribe for conveniently drawing a desired line over the surface of the work. Another object is to permit the use of a pencil or a steel pin as the scribing tool.

WORK HOLDING CLAMP.—H. I. LAVERS, 30 Irving St., West Somerville, Mass. This invention relates generally to work holding clamps, and particularly to a clamp for holding portions of carpenter or cabinet work together until the glue used for uniting the same has become sufficiently set. It is the purpose of the invention to provide a clamping and forcing device in a single element so that the two functions are performed simultaneously.

GROOVE CUTTING TOOL.—J. A. LEWIS, 603 Kickapoo St., Hartford City, Ind. The object of this invention is to provide a tool adapted for rotary engagement within a piston ring groove of a piston and carrying a cutting blade whereby upon rotation of the tool upon the piston an oil groove will be cut, the particular advantage of the device being that it eliminates the necessity of placing the piston in a lathe to effect the cutting.

NUT LOCK.—J. A. YOUNG, Belair, Md. The invention relates to an arrangement for positively locking the nut on the bolt against turning, yet permitting minute adjustment and convenient application or removal of the nut. A further object is to provide a nut lock of that type in which the bolt is provided with



AN ELEVATION OF A BOLT AND NUT ENGAGED WITH LOCKING MEANS

a longitudinal groove, and the nut is equipped with an annular recess or chamber circumscribing the thread opening and adapted to accommodate a locking means in the form of a split ring adapted to simultaneously engage the bolt and nut to prevent the latter from turning on the former.

Heating and Lighting

HUMIDIFYING RADIATOR UNIT.—F. E. GROSVOLD, address A. H. Shoemaker, Eau Claire Natl. Bank Bldg., Eau Claire, Wis. This invention refers more particularly to a radiating unit which has a receptacle for water bordering the edges of the heating space through which the heating medium is circulated. An object is to provide a unit having a humidifier associated therewith, which may be attached at any desired point of a complete radiator. The unit is suitable for any method of heating in which radiators are employed.

WATER SEAL VACUUM VALVE.—J. H.

(Continued on page 556)

Making the Barge Canal Pay

(*Continued from page 553*)

Gowanus Bay Terminal in Brooklyn. The Oswego elevator will have a capacity of one million bushels of grain, while the Gowanus Bay structure will hold two million bushels. These elevators have been planned and their construction will be well under way in the near future.

The State of New York has done everything it could to make its waterway a success. The officials having to do with canal matters have exerted every effort to push the project to completion, and it is now strictly up to the people to cooperate and by coöperation obtain all the benefits to be derived from the full utilization of the canal system that has been provided. There are four definite lines of work which can be followed to make New York's waterway a great carrier. These are: First, to urge upon members of the Legislature favorable action on appropriations for the further development of canal terminals; second, to assist in the organization of competent operating companies and the construction of barges; third, to divert freight to the Barge Canal and urge similar action upon others; fourth, to seek coöperation between shippers and carriers and the coördination of fresh and salt water transportation facilities.

Tuning and Testing

(*Continued from page 545*)

passes this test, it is running so smoothly that a new dollar or a pencil can be balanced on top of the engine and will stand without falling.

The defects which are found inside the engines are usually of the kind that can be detected only with the stethoscope. One such is what is known as "piston slap." This is a noise so small that no automobile engineer discovered it until other noises were eliminated by the construction of the smooth and silent engines that are being turned out today. It is notable that the discovery of this noise was made in American and not in European engines. The reason is that in many makes of motors, including several of the famous European cars, the pistons can slap persistently and no one can discover it because of other noises.

Of course, engines which fail to pass this test and are sent back for tuning up, must come again to the dynamometer rooms and eventually pass 100 per cent in every way.

Thus, in the finished product, the results of American quantity plus quality work come to a focus. The selection of metals, the scientific heat treatment which surpasses anything that can be accomplished by the judgment of the most skilled worker, the accurate machine work and the inspection which insures uniformity of product, have all contributed to an unequaled result. An engine is turned out that is without a peer and yet is turned out in large quantities and of so uniform and perfectly standardized construction that in case any one of its hundreds of parts needs replacement, the first piece that comes from the stock bin will fit and function perfectly.

A single example of the ultimate test of the results obtained, completes proof of American superiority. There is a single company operating a bus line in California which is now running 52 cars of a high grade American make and keeps in reserve only three cars to replace possible break-downs and to permit repairs, service, and overhauling. Each of these cars makes an average run of 340 miles a day. Some of them have been in service for years and at least eight of them have run up a total mileage of about 300,000 miles while one has passed 350,000 miles.

European production has offered nothing which can in any way compare with this record of American achievement either in quality or quantity manufacture.

The Dawn of American Commercial Aviation

(*Continued from page 546*)

As to the useful load, this is represented by the following items:

	Pounds
Passengers (11)	1,980
Mail	500
Crew (2)	360
Gasoline (230 U. S. gallons)	1,437
Oil (20 U. S. gallons)	150
Total useful load	4,427

The total weight in flying order is therefore 12,883 pounds, or nearly six and a half tons.

This great weight is carried by biplane wings of an aggregate supporting area of 1,397 square feet. The upper wings have a spread of 103 feet 9 inches, while the lower wings are 74 feet 4 inches in span. The wing chord measures 8 feet and the interplane gap, that is, the perpendicular distance between the upper and the lower wings, 8 feet 10 inches. The overall length of the machine, from the stem to the trailing edge of the rudder, is 49 feet 3 inches, and the overall height 18 feet 9 inches.

The propelling apparatus consists of two naval type Liberty XII engines, which have a total consumption of 64.2 gallons of gasoline and 3 gallons of oil per hour for an output of 700 horsepower. The engines are mounted with their direct drive propeller between the wings on either side of the center line. An electric starter fitted in the cockpit enables the pilot to get under way without outside assistance. The full speed these flying boats develop is 85 miles per hour, while the landing speed is 50 miles per hour.

Perhaps the most striking feature of these air liners is their extremely sturdy construction. The generous size of wing spars and interplane struts as well as the obvious strength of the double-planked hull, built of Port Orford cedar, are likely to prove a revelation to the layman who still pictures aircraft as flimsy contraptions of sticks and wires.

The first of these Aeromarine liners last summer safely carried hundreds of passengers from New York to Atlantic City, Newport, R. I., Southampton, L. I., and other places on the Atlantic coast. These performances and the splendid war record of these flying boats are the best proof that the Key West to Havana airway will be operated with craft which fully deserve the confidence of the traveling public.

That the establishment of an airway between Key West and Havana saves the traveler both time and inconvenience will be obvious from the following: Travelers who arrive at Key West at 2 P. M. have to wait eight hours for the boat to Havana and the sea voyage consumes the whole night, the boat reaching the Cuban capital only the following morning. The Aeromarine liners now leave Key West half an hour after the arrival of the train and cover the odd hundred miles' distance to Havana in an hour and a quarter. The traveler is thus spared the inconvenience of a tedious sojourn in Key West and the even less pleasing prospects of seasickness before seeing Morro Castle, while the actual saving in time represents virtually a whole day.

What such a shortening of the trip between New York and Havana means to the man who has to take the trip owing to urgent business reasons or personal affairs is obvious. The experience of the London to Paris airway shows that people in a hurry invariably take the airway in order to escape the delays attendant upon inadequate rail and boat connections. But it may be expected that besides the man-in-a-hurry there are other travelers who will take to the air. The desire

(*Continued on page 557*)

RECENTLY PATENTED INVENTIONS

(*Continued from page 554*)

LINDSAY, 1117 Jefferson Ave., Brooklyn, N. Y. An object of this invention is to prevent the escape of steam and to render the thermostatic element quickly responsive to the level of water and to the contact of steam therewith so as to cause the valve to operate and maintain at all times a water seal at the valve outlet to prevent the escape of steam.

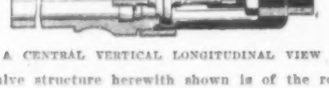
APPARATUS FOR RETURNING WATER TO BOILERS.—D. N. CROSTHWAIT, JR., Marshalltown, Iowa. The invention relates to means by which water may be fed or returned to a boiler from a level lower than the water line of the boiler. An object is to provide water return pumps or traps operated automatically by steam pressure applied to the body of water in the trap, and particularly by aid of an ejector located in the receiver and to which steam is directly admitted.

HOT AIR HEATER.—J. W. FIEBER, Shaw, Ore. The particular object of the invention is to provide devices for heating air for use in fruit evaporators, the heater is capable of utilizing a variety of heating means as well as one which will produce a very dry heated air and may be easily and quickly attended to. A further object is the provision of a heater by means of which the fruit may be dried with a proportionately reduced loss in weight and better color.

Machines and Mechanical Devices

EMULSIFYING MACHINE.—J. F. SCHLAPP, 1917 Grand View Blvd., Sioux City, Iowa. The invention has for its object to provide an emulsifying machine by means of which an emulsion between two or more substances not capable of chemical combination may be intimately mixed to form the emulsion. The emulsifier is simple in construction, easy to operate and inexpensive to manufacture.

VALVE STRUCTURE FOR OIL WELLS.—J. P. MCEVOY, Box 206, Sour Lake, Texas. An important object of the invention is to provide a structure with a view to increasing the efficiency and durability of the device. The



A CENTRAL VERTICAL LONGITUDINAL VIEW

valve structure herewith shown is of the reciprocatory type, and is employed in the well casing of an oil well. It may also be embodied in a standing valve structure, wherein the barrel or body portion of the device is stationary.

FLYWHEEL BALANCER.—M. MACHROL, 570 Prairie Ave., Kenosha, Wis. An object of the invention is to provide a device by means of which the surplus metal on one side of a flywheel may be readily located and removed. A further object is to provide a device having a scale which will indicate the amount of metal to be removed, and to provide a fly balancing device which consists of few parts, therefore easily constructed and not liable to get out of order. The device may be adjusted to flywheels of different sizes.

OIL RETAINER.—H. C. UTTECH and A. E. OHRMUNDT, Lebanon, Wis. This invention has for its object to provide a construction and arrangement of oil retainer in connection with a gear case or machine element of any character, which permits a free lubrication and yet which maintains a leak proof gasket around the shaft. The device dispenses with the necessity for the ordinary stuffing box and consequent frictional engagement with the shaft.

MACHINE FOR HANDLING ENSILAGE.—G. A. LONG, Mooresville, Ind. This invention relates to machines for handling ensilage and has for its object to provide a device especially adapted for use in silos for tamping the ensilage as it is placed in the silo, wherein the machine is operated by the feeding of the ensilage from the cutter; the ensilage is fed to the silo through a sectional pipe, the lower sections being removed as the silo fills.

SHANK BUTTON MACHINE.—B. VESELY and W. FAJMAN, address Bedrich Vesely, 1145 4th Ave., Astoria, L. I., N. Y. The invention has particular reference to means for forming shanks and drilling the eyes through the shanks of shank buttons such as are commonly made from clam shells, or other natural material or its equivalent. Among the objects is to provide a machine of a relatively simple, compact and reliable nature adapted for rapid manipulation.

FLEXIBLE COUPLING.—G. E. TOMLINSON, Winchester, Ky. This invention relates to a flexible coupling which may be employed in conjunction with any type of power-driven shaft where the driven shaft extends at a fixed or varying angle to the driving shaft, which coupling will require no attention whatever, such as oiling, wherein the wear will be reduced to a minimum, and which will be capable of absorbing shocks to a certain extent.

ADJUSTABLE CHASE AND LOCKUP FOR PRINTING, CUTTING AND CREASING PRESSES.—E. KARL, 20 W. Main St., Litchfield, Conn. An object of the invention is to provide a device which will securely clamp the plate and which is capable of a wide range of adjustment. With this mechanism the operation can be quickly performed and the device will securely clamp the plate or type set up. While the parts are adjustable, they are rigidly fixed when once clamped in position.

DEVICE FOR ARCHING AND FITTING SEMI ELLIPTIC SPRINGS.—J. I. ROBERTS, Box 635, Prescott, Arizona. The invention relates to devices for forming and shaping semi-elliptic springs. An object is to provide a device adapted more particularly for use in the blacksmith's shop. The device comprises a trestle, a presser frame with handle to be borne on by the operator, a fixed presser roll with a handle for turning it, and a companion presser roll with a swinging mounting on the frame.

APPARATUS FOR HARD TWISTING OF FINE AND THICK THREADS.—H. P. MITTET, Aviesund, Norway. The object of this invention is to provide an apparatus for hard-twisting of thread, to be placed on an ordinary twisting machine with pliers or a similar machine, by means of which the thread is given a sufficient twist, and from which the thread is passed directly to the twisting machine in a continuous process.

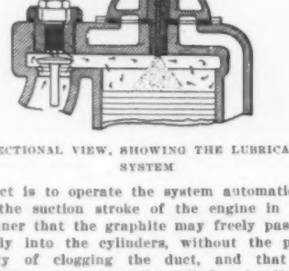
ROLLER CLEANER.—M. E. VAN BROCKLEN and R. HAIDEN, 4 Mohawk Place, Amsterdam, N. Y. This invention has for its object to provide a device adapted for use with spinning mules, for cleaning the rollers of the spinning jacks, wherein the arrangement is such that when the cleaner is placed upon the roller it will travel the full length of the roller, thoroughly cleaning the same, and requiring no supervision on the part of the spinner, and it may be used upon many machines.

Musical Devices

MUSIC LEAF TURNER.—J. O. GEMSEY, Montevideo, Minn. The purpose of this invention is to provide a music leaf turner adapted to be applied to a music stand of the standard construction, which can be readily adjusted to fit the stand irrespective of its height, the turning mechanism being adapted to be actuated by the foot of the operator for successively turning the leaves as they are played.

Prime Movers and Their Accessories

AUTOMATIC GRAPHITE LUBRICATING SYSTEM FOR INTERNAL COMBUSTION ENGINE CYLINDERS.—J. D. LOOG, 447 E. 173rd St., New York, N. Y. The invention relates to a system of lubrication in which finely divided flaked graphite is directly admitted into the cylinders without loss of compression. An



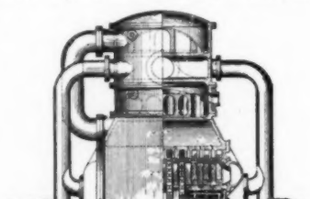
A SECTIONAL VIEW, SHOWING THE LUBRICATING SYSTEM

object is to operate the system automatically by the suction stroke of the engine in such manner that the graphite may freely pass directly into the cylinders, without the possibility of clogging the duct, and that the graphite on reaching the cylinders be distributed with the help of the inrushing gas vapor on the walls, where it forms a lubricating film.

POWER TRANSMISSION.—W. C. NUTT, Port Marion, Pa. An object of the invention is to provide mechanism for transmitting motion from a drive shaft to a crankshaft at right angles thereto. A further object is to provide a cam wheel and oscillating rame with rollers on the frame engaging the face of the cam wheel and compelling the movement of the frame due to the changing angular disposition of the cam wheel.

COMMUTATOR GRINDER.—F. E. FULLER, 1550 Williamette Blvd., Portland, Ore. This invention more particularly relates to a grinder or polisher for removing accumulations of dirt, and truing up the contacting surfaces of a commutator or timer for internal combustion engines. An object is to provide a simple grinder which is of such nature that it can be readily applied and easily removed.

MARINE STEAM TURBINE.—A. M. RODBERG, Box 1772, Tampa, Fla. This invention relates more particularly to a heavy duty reversible turbine for marine use, and among its various objects aims to utilize the expansive



A SIDE VIEW PARTLY IN SECTION

and impact force of steam to a maximum degree and at the same time provide for ready reversibility and similar speeds and power in both ahead and astern duty.

CARBURETING SCREEN.—F. W. LAPHAM, 5035 W. 33nd St., Cicero, Ill. The invention relates to a combined cylinder gasket and screen for use in connection with internal combustion engines. An object is to provide a screen arranged at or near the intake valve, and which is adapted to thoroughly atomize and vaporize the charge prior to its passage into the cylinder. A further object is to render the installation of the screen simple and easy.

COMBINED BY-PASS AND RELIEF VALVE.—E. B. WHELAN, 1025 S. 10th St., Omaha, Neb. This invention relates to that class of valves which are adapted to be used in steam engines of the piston-valve type, and individually to perform in such an engine, as occasion may require, the function of a by-pass valve and also the functions of a vacuum and compression relief valve.

Railways and Their Accessories

RAIL JOINT.—D. MCEACHERN, Box 922, Nelson British Columbia, Canada. The invention relates to rail joints of that type wherein the ends of rails are not only connected, but are supported as well, so as to prevent excessive vibration of their contiguous extremities, the object is the provision of a simple means for maintaing the parts under an active tension at all times directed toward tightening the same and compensating for wear.

RAILWAY GATE CONTROL MECHANISM.—F. W. GRANT, 674 Marlborough St., Detroit, Mich. An object of the invention is to provide means without the use of a complicated construction, for the protection of street crossing railways by gates which are automatically closed by electrical energy on the approaching of a train from either direction, and automatically opened after the train has passed the crossing.

Pertaining to Recreation

TOY MACHINE GUN.—H. ABRAMOWITZ, 176 Eldridge St., New York, N. Y. The general object of the invention is to simplify the construction and operation of toys of this character so as to be efficient in use, and inexpensive to manufacture, and so designed as not to readily get out of order. A more specific object is the provision of a machine gun which by operating a single crank, causes the projecting of a bullet and the explosion of a cap.

GAME BOARD.—EMMA N. LAMBERT, 511 Seminole St., Bethlehem, Pa. An object of the invention is to provide an arrangement of lines and spaces for use with game pieces for the playing of different games. A further object is to provide a game board which will be ornamental and attractive in appearance, and cheap to manufacture and entertaining in use.

Pertaining to Vehicles

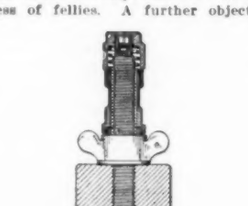
SPARK AND THROTTLE LEVER LOCK.—J. H. PRICE, 322 N. Ellis St., Cape Girardeau, Mo. The aim of this invention is to provide a locking device capable of ready adjustment to fit spark and throttle levers of slightly different spacing. A further object is the provision of an arrangement wherein means are incorporated to avoid danger of defeating the purposes of a lock by unwarranted opening of the quadrant and shifting movements of the spark and throttle levers beneath the lock plate.

PATCH HOLDER.—C. A. ERDLEY, Mifflinburg, Pa. The invention relates to a device for holding an inside blow-out patch within a tire while the tire is being placed upon a rim; the patch including flaps passing beneath the beads of the tire, clasps engageable with the flaps, and a member connecting the clasps, whereby they may be drawn snugly against the outer periphery of the tire to hold the flaps firmly and prevent shifting of the patch.

MOTORCYCLE SEAT.—M. E. WOOD, 255 1st St., South Amboy, N. J. One of the objects of the invention is to provide a tandem seat suspension which may be readily applied to a single seater motorcycle as an attachment. A still further object is to provide a seat embodying a self-contained construction in which a foot rest is provided, and employing an elliptical spring as the resilient means with means for adjusting the seat to accommodate the user.

WHEEL LOCK.—C. E. THOMPSON, 222 E. 89th St., New York, N. Y. Among the objects of the invention is to provide a wheel lock which is adapted to be secured around the tire and rim of a wheel to prevent turning movement. A further object is to provide a lock which dispenses with the necessity for a key and which cannot be operated except by a person having knowledge of the movements necessary to release the device.

DUST CAP FOR TIRE VALVE.—G. B. MULLEN, Bell Ave. and Broadway, Bay Side, L. I., N. Y. Among the objects of the invention is to provide in combination a closure for the valve stem and a dust cap in which is provided means to compensate for the varying thickness of fellies. A further object is to



A VERTICAL SECTION VIEW OF THE DEVICE AS APPLIED

provide a dust cap which reduces the time of labor required for the inflation of the tire to a minimum by obviating the necessity of separately removing the dust cap and the valve stem cap.

BLOW OUT PATCH.—W. VAN V. HAYES, 772 Park Ave., New York, N. Y. The invention relates generally to means for repairing pneumatic tires in such a way that the device may be used either as a blow out patch or inner lining or the like. The primary object is to employ a conventional type of patch in so far as concerns its body portion, but instead of using the ordinary flaps or aprons to so construct the flaps that the patch will not slip, creep or otherwise move from its strengthening relation relative to the tire.

Designs

DESIGN FOR A JEWELRY HOLDER.—P. VIGGIANO, address Hugh M. Martin, Shinnston, W. Va.

DESIGN FOR A POURING SPOUT FOR CANS.—H. L. STRONGSON, 147 West Broadway, New York, N. Y.

The Dawn of American Commercial Aviation

(*Continued from page 555*)

to escape seasickness will probably be one of the causes, while the enchantment the aerial traveler experiences aloft will offer a further inducement to go *via* the air route. And European experience shows that the keenness of this latter class of travelers for air transport increases with each trip.

In the Modern Saw-Mill

(*Continued from page 548*)

automatic unstackers facilitate handling.

Handling the refuse of a large lumber mill presents a considerable problem. It consists largely of dust, edgings, and trimmings and a large proportion of it is used for fuel. Shavings and dust are lifted by suction and blown directly to the fuel bins. Slabs from the slasher and stub ends from the trimmer are suitable for making broom handles, lath, and the like and after all usable material has been picked out, the waste goes to the "hog" which cuts the refuse up in small pieces for fuel.

Shingle machines are operated in connection with the mill. The lumber is cut into bolts for them and their action is entirely automatic. The din from a battery of these machines is deafening.

Not only does the waste from a lumber mill furnish sufficient fuel to operate all the machinery, but there are instances where the lumber company sells electric power to the local light and power concern, which in turn sells it to other consumers.

The transfer of lumber in and around the mill was for many years mainly done by means of hand trucks. Two electrical devices have replaced this antiquated system—the storage battery truck and the telpher or monorail. The latter consists of an overhead rail from which is suspended a car or cars, equipped with electric hoists, the operator riding in the car. The telpher is, of course, restricted in its movements and electric trucks are used for the miscellaneous hauling that has to be done.

Even in a plant where the fuel costs nothing it is important to have an economical steam installation, because the greater the steam demand the greater the investment in the boiler room and its maintenance. For this reason steam turbines have replaced reciprocating engines in many mills. In others, where the power requirements have outgrown the capacity of the plant, steam turbines have been installed which receive their steam supply from the exhaust of the old reciprocating engine. Such installations have been made to deliver one horsepower for every horse-power delivered by the original plant. In other words the capacity of the plant is doubled with no additional operating expense.

In some cases where the use of steam in a few operations is insisted on a mixed pressure turbine has been installed. This turbine consists of two elements, one of which operates on high pressure steam and the other on the low pressure exhaust steam from the auxiliary engines.

Certainly our big lumber mills cannot be accused of wasteful methods. They are manufacturing plants of the most efficient type, in which both material and human effort are conserved to a fine degree.

Carbonic Acid Gas to Fertilize the Air

(*Continued from page 549*)

toward the plants, thus allowing extensive areas to be supplied with the fertilizing gas. On the opposite side of the greenhouse plant there was provided for checking purposes a plot of the same size submitted to no carbonic acid gas, the soil in the two plots being of the same quality. Samples were derived from the best portions of the checking field, but from the center of the field submitted to the action of carbonic acid gas, the increase in yield in the case of spinach being found to be 150 per cent, with potatoes 180 per cent, with lupines (a legume) 174 per cent, and with barley 100 per cent. The potatoes in the field submitted to the action of carbonic acid gas were found to ripen much more quickly than in the checking plot.

The testing plant in view of these surprisingly favorable results was eventually extended, three greenhouses of the same size as those existing being added, while the small open-ground plant was increased considerably and more extensive grounds—30,000 square meters—were provided with an underground central pipe and branch pipes encircling lengthy plots. Especially favorable results were obtained on this field with potatoes, a 300 per cent increase being recorded in connection with tests on a large scale.

All experiments so far made go to show that fertilizing the air by means of carbonic acid gas is a much more efficient process than even an increased fertilization of the ground with stable manure and cow dung. If, on the other hand, a plot fertilized from the air at the same time be submitted to soil fertilization, the latter, on account of the increased need for other elements (nitrogen, phosphorus, potassium, etc.) entailed by the increased absorption of carbonic acid, can be driven much farther than otherwise.

According to Dr. Riedel's calculations an iron works dealing in its blast-furnaces with about 4,000 tons of coke per day will daily produce as much as 35 million cubic meters of combustion gases, containing 20 per cent carbonic acid gas. This is such an enormous amount that even in the case of a partial utilization most extensive plots of ground can be supplied with the precious air fertilizer. Dr. Riedel therefore believes that carbonic acid works for supplying agriculture will before long be quite as common a feature as electricity and gas works, the large industrial centers at the same time becoming centers of increasing agricultural production.

Careful analysis has shown the increase in the percentage of carbonic acid in the air to remain far below the limit where the gas becomes liable to endanger the health of man.

Mechanical Stevedore That Handles Bananas

(*Continued from page 549*)

suspended rigidly from above at intervals: monorail trolleys of 250 pounds capacity, having roller bearings to carry the bunch of bananas suspended from a special hook to which the bunch is hung by a loop device invented by Mr. Steckler for the purpose; and a power-driven chain provided with fingers at three-foot centers, in constant motion at the rate of 125 feet a minute, the path of motion being parallel to the monorail at such location that the fingers engage the suspended bunch of bananas, and thus push the trolley along on the monorail.

The accompanying photograph illustrates the device. One track (Loop L-1) is parallel with the ship. It connects with several switches, each swiftly operated by compressed air. Down one switch the bananas that are turning ripe are first shunted to the waiting cars or wagons. The green ones are diverted down another switch, following the entire line of box cars on the siding. From this main line switch, a dead-rail line branches out in front of each car. The dead rail is down grade to the car door, and the bunches of bananas are delivered there without human handling. There are bumpers to prevent the bruising of the fruit. After the trolley is unloaded, it is sent back to its point of origin by a separate return system, and is there reloaded for further use.

It will thus be seen that there are only a few trolley switchmen between shipside and the cars, where formerly at least 400 men were working. These switchmen

are also inspectors, who would have been employed anyway under the old system.

Under the old system, to unload a cargo of 35,000 bunches required seven to eight hours and the services of 400 laborers for distribution to cars, giving at least 2,800 man-hours at 50 cents, a total of $1,400, or about 4 cents a bunch. Under the new system the same cargo is unloaded in five hours or less; no laborers are required for distribution. The cost includes a special loop device (which cannot be salvaged) for each bunch, 35,000 at 1½ cents, $525; one chief and three assistant operator mechanics at a total cost of $27; power consumption for distributor system at $16; and upkeep, including oil, depreciation, $12; a grand total of $580, with a difference in favor of the new system of $820, or more than 2¼ cents a bunch.

By extending the system into the ship itself, there will be a still great saving in time and money. Mr. Steckler is working on a plan whereby the under side of each deck of the fruit ships will be equipped with monorails radiating to the hatch opening; from here the trolleys, loaded with bunches of bananas, will be lifted by a marine tower, similar to the present device, and so transferred direct, without further handling, to the wharf monorail system.

The Sectional Unit Factory

(*Continued from page 550*)

by the simple expedient of adding more sections. Roof sections conforming to all the demands of the situation are to be had; and when the width is carried far enough to require one or more longitudinal rows of supporting columns, these are to be had, together with roof sections appropriately modified to meet the case. Our illustrations give an excellent idea of the manner in which these structures are put together, both with regard to the framework and the outer skin of steel and glass, and also leave the proper impression of extreme flexibility. On this point little more need be said than that lengths vary by multiples of two feet, the width of the wall sections; while widths vary by multiples of from four to ten feet, according to the style. It will be noted, particularly, that the standardized sectional factory is not limited to an absolute rectangle, but may have ells and wings as desired, as well as vertical skylights and other modifications of the roof outline. These buildings are in successful use in many industries, and appear to have a bright future. A more conclusive answer to the problems of the business that cannot afford to build, today, against the requirements of ten years hence, and can no better afford continually to be scrapping old buildings in favor of new ones, would hardly be imagined.

A New Idea in Factory Heating

(*Continued from page 550*)

maintenance cost is equally low. It is portable, requires no special foundation, and can be moved and relocated by common labor, ready for operation within a few hours. The principle is simple: Cool air at the floor level (or from outside) is drawn into the unit by a powerful fan-wheel), heated in its upward passage around steam-heated coils or a heated firing chamber, and then discharged at low velocity through directing outlet hoods into the open area. The gentle current of air thus established does not create drafts or air-blasts that impair the health of the employees. Where steam is available, the heater simply takes the place of the usual radiator; where steam is not available, the direct-fired type is required. Even under the severest conditions this heater requires firing only every four or six hours, so that its operation does not call for much attention.

Roller Bearings for Line Shafts

THE purpose of roller bearings is twofold: First, roller bearings reduce friction and thus reduce power losses; secondly, roller bearings by the same token resist wear. Hence it is with considerable interest that we hear of the success which has attended the use of special roller bearings for line shafts in various factories. Not only has a material saving in power been effected by the use of such bearings, but equipment of this kind has shown remarkable proof against wear and deterioration. For 29 years in some plants these bearings have been running easily and economically, saving power and lubricant.

Gravity as An Aid to Production

A PRODUCTION system is no more efficient than its line of supply. Keeping high-priced skilled hands busy, expensive machines "fed," output steady and up to capacity, is the job confronting the production man in small shop and large factory alike.

The story of the gravity conveyor is an old one, all well and true; but there is a decided touch of the novel in the very latest gravity conveyor installations. The leading factories today are using gravity conveyors in carrying materials and products from operation to operation, floor to floor, from automatic lathes to assembly department and from there to the packing room and shipping platform. The human wheel-lug-and-carry system is obsolete. Its drudgery involves a class of labor that cannot be other than indifferent, unreliable, inefficient. And the wages remain exorbitant.

In comparison the gravity system means all the difference between the ox-drawn plow of antiquity and the tractor-drawn gangplow. The gravity system can be arranged so that the production methods are served in the proper sequence. Starting at one end of the establishment, the materials and assembled articles can be conveyed along until finally they reach the shipping platform. The gravity systems are now constructed with switching arrangements, so that at a moment's notice the path of the flow can be diverted to meet changed requirements. All in all, the gravity method is as efficient as it is simple, and as flexible as it is positive in operation.

Results of the First Finnish Fair

THE first fair held in Finland was opened on June 27 and lasted 10 days. Its aim was to give a comprehensive picture of the industrial achievements of the country and of the progress and possible future development of its commerce and industries. There has been a better opportunity of organizing the industrial life of the country since Finland has been independent than there was before. Thus, for instance, it has been possible to establish chambers of commerce in the principal cities and in the centers of commercial activity. It was owing to their efforts that the first Finnish fair was organized and held.

All branches of Finnish trade and industry were represented. The foreign exhibit also was rather large and varied, although most of the foreign firms exhibited through their local representatives. The import restrictions, however, caused difficulties. Practically no bargains could be concluded and foreign exhibitors were disappointed.

As yet it is impossible to draw any conclusions in regard to the sales of Finnish products. Many factories are so busy that they cannot take orders except for future delivery. It was not expected that many foreign buyers would come here under existing conditions, and comparatively few came. The English, who are among Finland's best customers, did not take much interest in the fair, as they were already familiar with the products which they usually buy—timber and paper.

The fair has, however, brought many and has been of importance in that way. It has also shown the development of Finnish industry, and the general opinion is that it has been a success.

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(14358) W. L. writes: I am enclosing you one of your notes and queries No. 14341 that I do not exactly understand. In this you give the weight of sea matter at the bottom of the deepest known depth as 77.12 and the compressibility as 20 per cent of 1/5 denser than at the surface and I have read in your notes and queries before where you gave the weight as about 67.5 and the compressibility as 1/20 or 5 per cent, and as they do not seem to agree I am writing you this letter. A. The compressibility of water varies considerably as the pressure and temperature increases. The pressure at the depth of six miles is about 1,000 atmospheres. The compressibility at that pressure is .0000358 per atmosphere, or .0358 at the bottom. This works out as about 1/20, or 5 per cent, as you state, about 67.5 lbs. per cubic foot at the bottom of the ocean. It was by an inadvertence that we used 20 per cent in place of 1/20 for which we express our regret. There is however some uncertainty in these figures and they should not be used as more than approximations. The figures as given in the Smithsonian Physical Tables for pressures up to 3,000 atmospheres at temperatures up to boiling may be taken as the best available, if one requires the most accurate result to be had.

NEW BOOKS, ETC.

PHOTOGRAPHY AND ITS APPLICATIONS. By William Gamble, F.R.P.S. New York: Isaac Pitman and Sons. 12mo.; 132 pp.; illustrated.

A little different from the usual photographic handbook, this slim volume is rather a narrative of present-day photographical applications, prefaced by a brief historical sketch. Even though the reader may not be a practiser of the art, he will find this simple outline of operations attractive. It includes color processes, scientific and industrial uses, cinema work, and photography in warfare.

BUILDING SUBWAYS IN NEW YORK. By Fred Lavis. New York: Hill Publishing Company, 1915. 4to.; 73 pp.; illustrated.

This reprint of articles appearing in *Engineering News* during 1914 is a graphic account of an undertaking rivalling the Panama Canal in expenditure, with a total investment greater than many of our big railroads. The numerous problems presented and triumphantly solved make an absorbing story. A paper on the design of steel elevated railways, by Maurice E. Griest, rounds out an informative brochure.

ELECTRICITY. Its Production and Applications. By Reg. E. Neale, B.Sc. New York: Isaac Pitman and Sons. 12mo.; 136 pp.; illustrated.

Only a broad survey of the most salient features of the subject can be compressed into so small a compass, but as a review of the general nature of this force which has made ours the electrical age, of the methods by which it is produced and the many ways in which it is turned to account by man, this text performs a distinct service to the reader.

WHO'S WHO IN AMERICA. Vol. XI., 1920-1921. Edited by Albert Nelson Marquis. Chicago: A. N. Marquis and Company, 1920. 8vo.; 3,302 pp.

At one time, few men were deemed worthy of widespread interest until they had been dead for some years. Now we demand to know those who please us with a picture, a book, or an invention, or who occupy our administrative offices. The new issue of "Who's Who in America" has 23,443 biographies of such men; by turning to his own State or town in the geographical index, the reader will frequently be surprised to find some neighbor whose unostentatious work has won him national recognition. There is inspiration

as well as information in this biographical dictionary of the living, and we are pleased to note its increasing use by the schools. The pronunciation of the more difficult names is indicated, and the birth and residence statistics show an increasing percentage of names from the western States.

KNOWLEDGE ENHANCED. By Luther Stockton Fish. 1903 Woodland Avenue, Cleveland, Ohio: C. Hauser, 1920. 8vo.; 297 pp.; illustrated.

The main thesis of this book is an attempt to explain sleep by locating the sleep effectuating mechanism of the body. This, the author avers, comprises the eyes, the optic nerves, the peduncles and the mammillaries, these last forming the electrodes of the system and sleep being dependent upon the breaking of their contact.

THE AMERICANS IN THE GREAT WAR. Milltown, N. J.: Michelin Tire Company, 1920. 8vo.; Vol. I., 130 pp. Vol. II., 146 pp. Vol. III., 112 pp. Illustrated; colored maps and plans.

These volumes, part of a series of illustrated guides to the battlefields, cover the activities of our men in the second battle of the Marne (Vol. I.), the battle of Saint Mihiel (Vol. II.), and the Meuse-Argonne (Vol. III.) The sub-title, "a panoramic history and guide," is fitly descriptive of the excellent work. Offensives and plans of attack and defense are briefly sketched, with admirable plates of the dispositions and movements. Plain directions are given the tourist for finding the points of interest. Both stay-at-home and voyager will be quick to appreciate the unique merits of the guide.

HOW TO FLY AND INSTRUCT ON AN 'AVRO.' By F. Dudley Hobbs, B.A. New York: Longmans, Green and Company, 1919. 8vo.; 75 pp.; illustrated.

The author demonstrates his familiarity with the best methods of teaching aviation. While the manual uses the "Avro" in illustration of theory and practice, the exposition holds good, of course, for any airplane. Embodying British experience in the war, it provides material aid to instructional efficiency in civil aviation.

ETHICS AND NATURAL LAW. By George Lansing Raymond, L.H.D. New York: G. P. Putnam's Sons, 1920. 8vo.; 345 pp.

Desires of body and of mind are not necessarily developed from one another: often we become aware of a conflict between them, and that awareness functions as "conscience." Such is the thesis from which Professor Raymond extracts a fundamental principle that largely reconciles existing ethical theories. Although very closely and academically phrased, and inclined to the platitudinous in its later chapters, the work is a reconstructive review of ethical theories, makes distinctions that have vitality, and will repay the necessary study and application.

THE YACHTSMAN'S ANNUAL GUIDE AND NAUTICAL CALENDAR. Boston (134 Milk Street): Clarence B. Hogg, 1920. 8vo.; 404 pp.; illustrated.

Delayed by fire in the bindery, this hardy annual so familiar to yachtsmen and motorboat owners yet celebrates triumphantly its forty-second anniversary. Besides the usual encyclopedic information regarding tides, ports, rigs, and handling, a new coast pilot section covers all points from the St. Croix River to the Chesapeake. A nautical dictionary, signal codes, tables, and club directories are among the items, and the numerous folding charts are as prominent a feature as ever.

PLEADING FOR JUSTICE. By W. C. Burns. New York: Justice Publishing Company, 1920. 8vo.; 316 pp.; illustrated.

A "purpose" novel, interwoven by a love story, the purpose being to interest the reader in the equalization of freight rates and government ownership of the railroads, after a plan designed by the hero.

THE THEORY AND PRACTICE OF AEROPLANE DESIGN. By S. T. G. Andrews, B.Sc., and S. F. Benson, B.Sc. New York: E. P. Dutton and Company, 1920. 8vo.; 454 pp.; illustrated.

Like all the volumes of the "Directly-Useful Technical Series," this text-book supplies such a combination of theory and practice as will best serve the thorough-minded man. The first twelve chapters elucidate general principles and properties, stresses and strains, design as applied to particular parts, stability and performance, whereupon follows a chapter in which these considerations are applied to the lay-out of a complete airplane. The authors have had the coöperation of leading British manufacturers, publishers, and the Advisory Committee, and have utilized to the greatest advantage a striking collection of plates and diagrams that often serve the purpose of clearing up obscure points instantaneously, and always lend interest and definition to the text.

EXPERIMENTAL WIRELESS STATIONS. By Philip E. Edelman, E.E. New York: The Norman W. Henley Publishing Company, 1920. 8vo.; 392 pp.; illustrated.

This work, used extensively in war training camps, has been rewritten to include all recent improvements: the engravings are entirely new. The text assumes some knowledge of mathematics and electricity, presents the best practice in plain language, and develops basic principles in detail. There is much material on vacuum tube circuits, radio-telephony, and the mitigation of interference. The ambitious amateur will find here all the information necessary to qualify him for serious work in the commercial field.

MOTOR BOATS AND BOAT MOTORS. Compiled and edited by Victor W. Pagé, M.S.A.E. New York: The Norman W. Henley Publishing Company, 1920. 8vo.; 524 pp.; 372 illustrations.

Owners and operators of motor boats will doubtless find this such a manual as they have been waiting for. Part I, dealing with the construction and design of hull and fittings, gives classification and types with all details from stem to stern, and offers material aid in the selecting of a boat for any particular service; it concludes with five popular designs—working drawings and full building instructions—by A. Clark Leitch. Part II scrutinizes the power plant and its auxiliaries, with the features of leading types, ignition and starting systems, operation, care and repair. A final chapter describes seaplanes and flying boats, floats, power plants, installation, and control. The boating enthusiast will be pleased with the completeness and practicality of the material.

PRACTICAL PHYSICS. By Millikan and Gale. Revised in collaboration with W. R. Pyle, B.S. New York: Ginn and Company, 1920. 8vo.; 462 pp.; illustrated.

For many years the basic material of this text-book has proved its worth, and in its new form it continues to emphasize the daily environment of the pupil as a source of mental stimulation, devoting much space to the internal-combustion engine, the airplane, and the lessons of the war insofar as they touch upon physics. In arrangement and treatment the work is much improved. The full-page portraits of physicists, and the cuts illustrating recent achievements, add value to an elementary text of high merit.

THE LOCOMOTIVE. Vol. XXXII. Hartford, Ct.: The Hartford Steam Boiler Inspection and Insurance Company. 8vo.; 253 pp.; illustrated.

Bound into book form, these 1918-1919 numbers of *The Locomotive* present the usual array of accident news and statistics, fuel economy hints, and steam boiler instruction. Those looking for the newer points and practice in safety and economy will find the articles and drawings of definite aid toward these desirable goals.

DYKE'S AUTOMOBILE AND GASOLINE ENGINE ENCYCLOPEDIA. By A. L. Dyke, E.E. St. Louis: A. L. Dyke, 1920. 8vo.; 940 pp.; 532 illustrations.

The latest edition of this standard work adds supplements dealing with special makes of car, trucks and tractors, motorcycles, and airplanes. It combines in one volume a reference work and instruction book, presenting in the simplest manner the fundamental principles underlying construction, operation, care and repair. Everything picturable is shown in plates, charts, cuts, and folding inserts, so that little is left to the imagination, and frequently information required may be had by a glance at a drawing, and much time thus saved. The work has taken a deservedly prominent place as a practical instructor.

NEW GEOGRAPHY. Book One. By Alexis Everett Frye. New York: Ginn and Company, 1920. 4to.; 272 pp.; 650 pictures and maps.

Space will not allow mention of all the new features of this text. Topics are frequently introduced by means of a story; pictures, colored and uncolored, set the romance of industry before the child; the states are grouped according to industrial and climatic divisions—the War Department plan; industrial information is kept well to the front, and joined with history and civics to illuminate and emphasize geographical facts; the maps present a new color scheme, and none of the essentials of primary geography are slighted.

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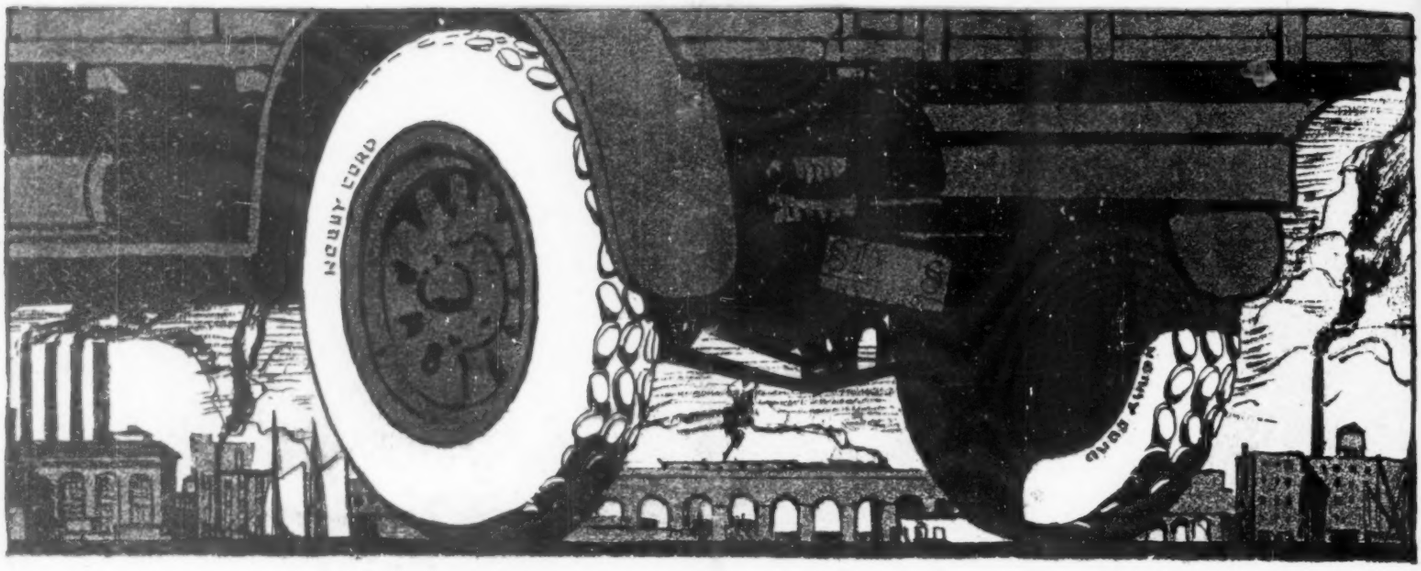

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